

GLMVArchitecture

PROJECT MANUAL

**City of Lee's Summit
Fire Station #5
Lee's Summit, Missouri**

100 percent Construction Documents Submittal

Architect's Project Number: 18225R21001

Date: October 27, 2022

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Fire Station #5
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TABLE OF CONTENTS

D 000000 0000

Civil Engineering Disclaimer of Responsibility
Landscape Architect Disclaimer of Responsibility
Structural Disclaimer of Responsibility
Architectural Disclaimer of Responsibility
Mechanical, Electrical, and Plumbing Disclaimer of Responsibility
Audio-Video, Technology, and Security Disclaimer of Responsibility

D 000000 00 – P 000000 000000 C 0000000000 R 000000 0000

000115 List of Drawing Sheets
003132 Geotechnical Data
Geotechnical Report for Fire Station #5 – Site #2, prepared by Alpha-Omega Geotech, Inc.,
dated August 10, 2021

D 000000 01 – G 000000 R 000000 0000

011000 Summary
012300 Alternates
012500 Substitution Procedures
013100 Project Management and Coordination
013200 Construction Progress Documentation
013233 Photographic Documentation
013300 Submittal Procedures
014000 Quality Requirements
015000 Temporary Facilities and Controls
016000 Product Requirements
017300 Execution
017419 Construction Waste Management and Disposal
017700 Closeout Procedures
017823 Operation and Maintenance Data
017839 Project Record Documents
017900 Demonstration and Training

D 000000 02 – E 000000 C 0000000000

Not Used

D 000000 03 – C 00000000

033000 Cast-In-Place Concrete

D 000000 04 – M 000000

042200 Concrete Unit Masonry
042613 Masonry Veneer
044313.13 Anchored Stone Masonry Veneer
047200 Cast Stone Masonry

D 05 – M

051200	Structural Steel Framing
053100	Steel Decking
054000	Cold-Formed Metal Framing
054400	Cold-formed Metal Trusses
055000	Metal Fabrications
055100	Metal Stairs
055213	Pipe and Tube Railings

D 06 – W, P, C

061000	Rough Carpentry
061600	Sheathing
064023	Interior Architectural Woodwork

D 07 – T, M, P

072100	Thermal Insulation
072419	Water-Drainage Exterior Insulation and Finish System (EIFS)
072726	Fluid-Applied Membrane Air Barriers
074213.13	Formed Metal Wall Panels
074213.16	Metal Plate Wall Panels
074293	Soffit Panels
075423	Thermoplastic-Polyolefin (TPO) Roofing
076200	Sheet Metal Flashing and Trim
077200	Roof Accessories
079200	Joint Sealants

D 08 – O

081113	Hollow Metal Doors and Frames
081416	Flush Wood Doors
083113	Access Doors and Frames
083323	Overhead Coiling Doors
083500	Four-Fold Doors
083613	Sectional Doors
084113	Aluminum-Framed Entrances and Storefronts
087100	Door Hardware
088000	Glazing
088300	Mirrors
088813	Fire-Rated Glazing

D 09 – F

092216	Non-Structural Metal Framing
092900	Gypsum Board
093000	Tiling
095123	Acoustical Tile Ceilings
096513	Resilient Base and Accessories
096519	Resilient Tile Flooring
096566	Resilient Athletic Flooring
096813	Tile Carpeting
099113	Exterior Painting

D 09 – F (C)

099123	Interior Painting
099300	Staining and Transparent Finishing
099600	High-Performance Coatings

D 10 – S

101400	Signage
101419	Dimensional Letter Signage
102800	Toilet, Bath, and Laundry Accessories
104413	Fire Extinguisher Cabinets
104416	Fire Extinguishers
105113	Metal Lockers
105240	Key Storage Cabinets
105600	Sliding Poles
105613	Metal Storage Shelving
107313	Awnings
107500	Flagpoles

D 11 – E

113100	Residential Appliances
--------	------------------------

D 12 – F

122413	Roller Window Shades
123661	Simulated Stone Countertops
124813	Entrance Floor Mats and Frames

D 13 – S C

Not Used

D 14 – C E

142600	Limited-Use/Limited-Application Elevators
--------	---

D 21 – F S

210500	Common Work Results for Fire Suppression
210523	General-Duty Valves for Water-Based Fire Suppression Piping
210553	Identification for Fire Suppression Piping and Equipment
210719	Fire Suppression Piping Insulation
211300	Fire Suppression Sprinkler Systems

D 22 – P

220517	Sleeves and Sleeve Seals for Plumbing Piping
220523	General-Duty Valves for Plumbing Piping
220529	Hangers and Supports for Plumbing Piping and Equipment
220553	Identification for Plumbing Piping and Equipment
220719	Plumbing Piping Insulation
221005	Plumbing Piping
221006	Plumbing Piping Specialties
221500	General-Service Compressed-Air Systems
223000	Plumbing Equipment
224000	Plumbing Fixtures

D 23 – H, V, A C (HVAC)

230513	Common Motor Requirements for HVAC Equipment
230517	Sleeves and Sleeve Seals for HVAC Piping
230519	Meters and Gauges for HVAC Piping
230523	General-Duty Valves for HVAC Piping
230529	Hangers and Supports for HVAC Piping and Equipment
230548	Vibration and Seismic Controls for HVAC
230553	Identification for HVAC Piping and Equipment
230593	Testing, Adjusting, and Balancing for HVAC
230713	Duct Insulation
230716	HVAC Equipment Insulation
230719	HVAC Piping Insulation
230913	Instrumentation and Control Devices for HVAC
231123	Facility Natural-Gas Piping
232113	Hydronic Piping
232114	Hydronic Specialties
232123	Hydronic Pumps
232300	Refrigerant Piping
233100	HVAC Ducts and Casings
233300	Air Duct and Accessories
233423	HVAC Power Ventilators
233439	High-Volume, Low-Speed Propeller Fans
233516	Engine Exhaust Systems
233700	Air Outlets and Inlets
235216	Condensing Boilers
237223	Package Air-to-Air Energy Recovery Units
237433	Dedicated Outdoor Air Units
238129	Variable Refrigerant Flow HVAC Systems

D 26 – E

260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533.13	Conduit for Electrical Systems
260533.16	Boxes for Electrical Systems
260553	Identification for Electrical Systems
260573	Power System Studies
260923	Lighting Control Devices
262100	Low-Voltage Electrical Service Entrance
262416	Panelboards
262726	Wiring Devices
262813	Fuses
262816.16	Enclosed Switches
262913	Enclosed Controllers
263213	Engine Generators
263323	Central Battery Equipment
263600	Transfer Switches
264300	Surge Protective Devices
265100	Interior Lighting
265600	Exterior Lighting

D 27 – C

270010	General Communications Requirements
270500	Common Work Results for Communications
271000	Structured Cabling System
271100	Telecommunications Equipment Room Fittings
271500	Communications Horizontal Cabling
274100	Audio Video Systems
274110	Telecommunications Requirements for Audio Video Systems
274116	Audio Video Systems Equipment
275123	Intercommunications and Program Systems

D 28 – E S S

280010	General Electronic Security System Requirements
280501	Common Work Results for Electronic Security Systems
281010	Conductors and Cables for Electronic Security
284600	Fire Detection and Alarm

D 31 – E

310513	Soils for Earthwork
310516	Aggregates for Earthwork
311000	Site Clearing
312213	Rough Grading
312316	Excavation
312323	Fill

D 32 – E I

321213	Concrete Paving
321216	Asphalt Paving
329000	Plants
329223	Sodding

D 33 – U

331416	Site Water Utility Distribution Piping
333100	Sanitary Sewerage Piping
334200	Stormwater Conveyance

E T C

CIVIL ENGINEER DISCLAIMER OF RESPONSIBILITY

I, Derick Holmes, hereby specify, pursuant to RSMo. 327.411 that the documents intended to be authenticated by my seal are limited to:

DRAWINGS

C-100 SITE PLAN
C-101 LAYOUT PLAN
C-102 DEMOLITION PLAN
C-103 EROSION CONTROL PLAN
C-104 GRADING & DRAINAGE PLAN
C-105 UTILITY PLAN
C-220 PUBLIC WATER PLAN & PROFILES
C-230 PUBLIC STORMWATER PROFILES
C-231 PRIVATE STORMWATER PROFILES
C-240 PUBLIC SANITARY SEWER PLAN & PROFILES
C-400 GRADING ENLARGEMENTS
C-500 SITE DETAILS
C-501 SITE DETAILS
C-502 SITE DETAILS
C-503 SITE DETAILS
C-510 EROSION CONTROL DETAILS
C-511 EROSION CONTROL DETAILS
C-520 WATER DETAILS
C-521 WATER DETAILS
C-530 STORMWATER DETAILS
C-531 STORMWATER DETAILS
C-532 STORMWATER DETAILS
C-540 SANITARY SEWER DETAILS

SPECIFICATIONS

DIVISION 31 – EARTHWORK
 310513 SOILS FOR EARTHWORK
 310516 AGGREGATES FOR EARTHWORK
 311000 SITE CLEARING
 312213 ROUGH GRADING
 312316 EXCAVATION
 312323 FILL

DIVISION 32 – EXTERIOR IMPROVEMENTS
 321213 CONCRETE PAVING
 310216 ASPHALT PAVING

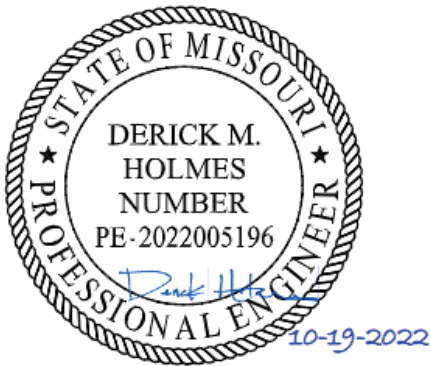
DIVISION 33 – UTILITIES

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

331416 SITE WATER UTILITY DISTRIBUTION PIPING
333100 SANITARY SEWERAGE PIPING
334200 STORMWATER CONVEYANCE

And I hereby disclaim any responsibility for all other drawings, specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the Lee's Summit Fire Station #5.

By:



City of Lee's Summit
Fire Station
Lee's Summit, Missouri

LANDSCAPE ARCHITECT DISCLAIMER OF RESPONSIBILITY

I, Kyle Ward, hereby specify, pursuant to RSMo. 327.411 that the documents intended to be authenticated by my seal are limited to:

DRAWINGS

L-100 LANDSCAPE SCHEDULE
L-101 LANDSCAPE PLAN

SPECIFICATIONS

DIVISION 32 – EXTERIOR IMPROVEMENTS
329000 PLANTS
329223 SODDING

And I hereby disclaim any responsibility for all other drawings, specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the Lee's Summit Fire Station #5.

By:



STRUCTURAL DISCLAIMER OF RESPONSIBILITY

I, Jordan Bennett, hereby specify, pursuant to RSMo. 327.411 that the documents intended to be authenticated by my seal are limited to:

DRAWINGS

S-001 GENERAL NOTES
S-100 FOUNDATION PLAN
S-101 LEVEL 2 FRAMING PLAN
S-103 LOW ROOF FRAMING PLAN
S-104 HIGH ROOF FRAMING PLAN
S-300 FOUNDATION SECTIONS
S-301 FOUNDATION SECTIONS
S-302 FLOOR SECTIONS
S-303 FLOOR SECTIONS
S-304 ROOF SECTIONS
S-305 ROOF SECTIONS
S-306 ROOF SECTIONS
S-307 MISC. DETAILS
S-500 TYPICAL DETAILS
S-501 TYPICAL DETAILS

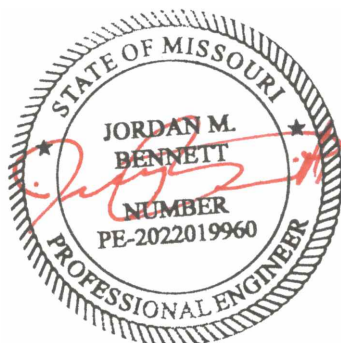
SPECIFICATIONS

DIVISION 03	CONCRETE
033000	CAST-IN-PLACE CONCRETE
DIVISION 04	MASONRY
042200	CONCRETE UNIT MASONRY
DIVISION 05	METALS
051200	STRUCTURAL STEEL FRAMING
053100	STEEL DECKING
054000	COLD FORMED METAL FRAMING
054400	COLD FORMED METAL TRUSSES
055000	METAL FABRICATIONS

And I hereby disclaim any responsibility for all other drawings, specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the Lee's Summit Fire Station #5.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

By: Jordan Bennett



10.19.2022

ARCHITECTURE DISCLAIMER OF RESPONSIBILITY

I, Paul J. Michell, hereby specify, pursuant to RSMo. 327.411 that the documents intended to be authenticated by my seal are limited to:

DRAWINGS

G-001 COVER SHEET
G-002 CODE SUMMARY
G-003 CODE MODIFICATION
G-004 STORM SHELTER SUMMARY
A-101 FIRST FLOOR PLAN
A-102 SECOND FLOOR PLAN
A-103 FIRST FLOOR DIMENSION PLAN
A-104 SECOND FLOOR DIMENSION PLAN
A-111 FIRST FLOOR REFLECTED CEILING PLAN
A-112 SECOND FLOOR REFLECTED CEILING PLAN
A-121 ROOF PLAN
A-201 BUILDING ELEVATIONS
A-202 BUILDING ELEVATIONS
A-301 BUILDING SECTIONS
A-401 WALL SECTIONS
A-402 WALL SECTIONS
A-403 WALL SECTIONS
A-404 WALL SECTIONS
A-410 ENLARGED STAIR PLAN AND SECTION
A-411 ENLARGED ELEVATOR PLAN
A-501 WALL DETAILS
A-502 WALL DETAILS
A-511 ROOF DETAILS
A-512 ROOF DETAILS
A-513 ROOF DETAILS
A-601 PARTITION TYPES
A-602 UL DETAILS
A-610 WINDOW ELEVATIONS
A-611 WINDOW DETAILS
A-612 WINDOW DETAILS
A-613 EXTERIOR DOOR DETAILS
A-621 DOOR AND FRAME SCHEDULE
A-622 DOOR DETAILS
I-001 TYPICAL MOUNTING HEIGHTS
I-201 INTERIOR DESIGN ELEVATIONS
I-202 INTERIOR DESIGN ELEVATIONS
I-203 APPARATUS BAY ELEVATIONS
I-501 CASEWORK SECTIONS
I-601 FINISH SCHEDULE

SPECIFICATIONS

DIVISION 0 – CONTRACTING REQUIREMENTS

000115 LIST OF DRAWING SHEETS

DIVISION 1 – GENERAL CONDITIONS

011000 SUMMARY
012300 ALTERNATES
012500 SUBSTITUTION PROCEDURES
013100 PROJECT MANAGEMENT AND COORDINATION
013200 CONSTRUCTION PROGRESS DOCUMENTATION
013233 PHOTOGRAPHIC DOCUMENTATION
013300 SUBMITTAL PROCEDURES
014000 QUALITY REQUIREMENTS
015000 TEMPORARY FACILITIES AND CONTROLS
016000 PRODUCT REQUIREMENTS
017300 EXECUTION
017419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
017700 CLOSEOUT PROCEDURES
017823 OPERATION AND MAINTENANCE DATA
017839 PROJECT RECORD DOCUMENTS
017900 DEMONSTRATION AND TRAINING

DIVISION 04 – MASONRY

042613 MASONRY VENEER
044313.13 ANCHORED STONE MASONRY VENEER
047200 CAST STONE MASONRY

DIVISION 05 – METALS

055100 METAL STAIRS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

061000 ROUGH CARPENTRY
061600 SHEATHING
064023 INTERIOR ARCHITECTURAL WOODWORK

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

072100 THERMAL INSULATION
072419 WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)
072726 FLUID-APPLIED MEMBRANE AIR BARRIERS
074213.13 FORMED METAL WALL PANELS
074213.16 METAL PLATE WALL PANELS
074293 SOFFIT PANELS
075423 THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING
076200 SHEET METAL FLASHING AND TRIM
077200 ROOF ACCESSORIES
079200 JOINT SEALANTS

DIVISION 08 – OPENINGS

081113 HOLLOW METAL DOORS AND FRAMES
081416 FLUSH WOOD DOORS
083113 ACCESS DOORS AND FRAMES
083323 OVERHEAD COILING DOORS
083500 FOUR-FOLD DOORS
083613 SECTIONAL DOORS
084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
087100 DOOR HARDWARE
088000 GLAZING

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

088300 MIRRORS
088813 FIRE-RATED GLAZING

DIVISION 09 – FINISHES

092216 NON-STRUCTURAL METAL FRAMING
092900 GYPSUM BOARD
093000 TILING
095123 ACOUSTICAL TILE CEILINGS
096513 RESILIENT BASE AND ACCESSORIES
096519 RESILIENT TILE FLOORING
096566 RESILIENT ATHLETIC FLOORING
096813 TILE CARPETING
099113 EXTERIOR PAINTING
099123 INTERIOR PAINTING
099300 STAINING AND TRANSPARENT FINISHING
099600 HIGH-PERFORMANCE COATINGS

DIVISION 10 – SPECIALTIES

101400 SIGNAGE
101419 DIMENSIONAL LETTER SIGNAGE
102800 TOILET, BATH, AND LAUNDRY ACCESSORIES
104413 FIRE EXTINGUISHER CABINETS
104416 FIRE EXTINGUISHERS
105113 METAL LOCKERS
105240 KEY STORAGE CABINETS
105600 SLIDING POLES
105613 METAL STORAGE SHELVING
107313 AWNINGS

DIVISION 11 – EQUIPMENT

113100 RESIDENTIAL APPLIANCES

DIVISION 12 – FURNISHINGS

122413 ROLLER WINDOW SHADES
123661 SIMULATED STONE COUNTERTOPS
124813 ENTRANCE FLOOR MATS AND FRAMES

And I hereby disclaim any responsibility for all other drawings, specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the Lee's Summit Fire Station #5.

By:



MECHANICAL, ELECTRICAL, & PLUMBING DISCLAIMER OF RESPONSIBILITY

I, Neil Bartley, hereby specify, pursuant to RSMo. 327.411 that the documents intended to be authenticated by my seal are limited to:

DRAWINGS

ME001 MPE SITE PLAN
ME002 SITE LIGHTING PHOTOMETRIC PLAN
ME101 MPE ROOF PLAN
M-001 HVAC SYMBOLS LEGEND
M-101 FIRST FLOOR HVAC PLAN
M-102 SECOND FLOOR HVAC PLAN
M-103 ROOF HVAC PLAN
M-201 FIRST FLOOR HVAC PIPING PLAN
M-202 SECOND FLOOR HVAC PIPING PLAN
M-301 MECHANICAL DETAILS
M-401 MECHANICAL SCHEDULES
M-402 MECHANICAL SCHEDULES
P-001 PLUMBING SYMBOLS LEGEND
P-100 UNDERGROUND PLUMBING PLAN
P-101 FIRST FLOOR PLUMBING PLAN
P-102 SECOND FLOOR PLUMBING PLAN
P-301 PLUMBING DETAILS
P-302 WASTE AND VENT RISERS
P-303 DOMESTIC WATER RISERS
P-401 PLUMBING SCHEDULES
E-001 ELECTRICAL SYMBOLS LEGEND
E-101 FIRST FLOOR LIGHTING PLAN
E-102 SECOND FLOOR LIGHTING PLAN
E-201 FIRST FLOOR POWER PLAN
E-202 SECOND FLOOR POWER PLAN
E-401 FIRST FLOOR FIRE ALARM PLAN
E-402 SECOND FLOOR FIRE ALARM
E-501 ELECTRICAL DETAILS
E-502 ELECTRICAL ONE-LINE
E-600 ELECTRICAL SCHEDULES
E-601 PANELBOARD SCHEDULES

SPECIFICATIONS

DIVISION 21 – FIRE SUPPRESSION

210500 COMMON WORK RESULTS FOR FIRE SUPPRESSION
210523 GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING
210553 IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT
210719 FIRE SUPPRESSION PIPING INSULATION
211300 FIRE-SUPPRESSION SPRINKLER SYSTEMS

DIVISION 22 – PLUMBING

220517 SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING
220523 GENERAL-DUTY VALVES FOR PLUMBING PIPING
220529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

220719 PLUMBING PIPING INSULATION
221005 PLUMBING PIPING
221006 PLUMBING PIPING SPECIALTIES
221123 FACILITY NATURAL GAS PIPING
221500 GENERAL-SERVICE COMPRESSED-AIR SYSTEMS
223000 PLUMBING EQUIPMENT
224000 PLUMBING FIXTURES

DIVISION 23 – HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

230513 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230517 SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
230519 METERS AND GAUGES FOR HVAC PIPING
230523 GENERAL-DUTY VALVES FOR HVAC PIPING
230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230548 VIBRATION AND SEISMIC CONTROLS FOR HVAC
230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230593 TESTING, ADJUSTING, AND BALANCING FOR HVAC
230713 DUCT INSULATION
230716 HVAC EQUIPMENT INSULATION
230719 HVAC PIPING INSULATION
230913 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC
232113 HYDRONIC PIPING
232114 HYDRONIC SPECIALTIES
232123 HYDRONIC PUMPS
232300 REFRIGERANT PIPING
233100 HVAC DUCTS AND CASINGS
233300 AIR DUCT ACCESSORIES
233423 HVAC POWER VENTILATORS
233439 HIGH-VOLUME, LOW-SPEED PROPELLER FANS
233516 ENGINE EXHAUST SYSTEMS
233700 AIR OUTLETS AND INLETS
235216 CONDENSING BOILERS
237223 PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS
237433 DEDICATED OUTDOOR AIR UNITS
238129 VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

DIVISION 26 - ELECTRICAL

260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533.13 CONDUIT FOR ELECTRICAL SYSTEMS
260533.16 BOXES FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
260573 POWER SYSTEM STUDIES
260923 LIGHTING CONTROL DEVICES
262100 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE
262416 PANELBOARDS
262726 WIRING DEVICES
262813 FUSES
262816.16 ENCLOSED SWITCHES
262913 ENCLOSED CONTROLLERS
263213 ENGINE GENERATORS
263323 CENTRAL BATTERY EQUIPMENT
263600 TRANSFER SWITCHES
264300 SURGE PROTECTIVE DEVICES
265100 INTERIOR LIGHTING
265600 EXTERIOR LIGHTING

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
284600 FIRE DETECTION AND ALARM

And I hereby disclaim any responsibility for all other drawings, specifications, estimates, reports, or other documents or instruments relating to or intended to be used for any part or parts of the Lee's Summit Fire Station #5.

By:



AUDIO-VIDEO, TECHNOLOGY, AND SECURITY DISCLAIMER OF RESPONSIBILITY

I, Mark D Maurer, hereby specify, pursuant to RSMo. 327.411 that the documents intended to be authenticated by my seal are limited to:

DRAWINGS

TA000 AUDIO-VIDEO GENERAL NOTES
TA001 AUDIO-VIDEO SYMBOLS
TA101 AUDIO-VIDEO LEVEL 1 PLAN
TA102 AUDIO-VIDEO LEVEL 2 PLAN
TA201 AUDIO-VIDEO LEVEL 1 RCP
TA600 AUDIO-VIDEO SCHEDULES AND SIGNAL FLOWS

TN000 TECHNOLOGY GENERAL NOTES
TN101 TECHNOLOGY LEVEL 1 PLAN
TN102 TECHNOLOGY LEVEL 2 PLAN
TN201 TECHNOLOGY LEVEL 1 RCP
TN202 TECHNOLOGY LEVEL 2 RCP
TN400 ENLARGED PLANS
TN500 TECHNOLOGY DETAILS

TY000 - SECURITY GENERAL NOTES
TY100 - SECURITY SITE PLAN
TY101 - SECURITY LEVEL 1 PLAN
TY102 - SECURITY LEVEL 2 PLAN
TY500 - SECURITY DETAILS

SPECIFICATIONS

DIVISION 27

270010 GENERAL COMMUNICATIONS REQUIREMENTS
270500 COMMON WORK RESULTS FOR COMMUNICATIONS
271000 STRUCTURED CABLING SYSTEM
271100 TELECOMMUNICATIONS EQUIPMENT ROOM FITTINGS
271500 COMMUNICATIONS HORIZONTAL CABLING
274100 AUDIO VIDEO SYSTEMS
274110 AUDIO VIDEO TELECOMMUNICATIONS REQUIREMENT
274116 AUDIO VIDEO SYSTEMS EQUIPMENT
275123 INTERCOMMUNICATIONS AND PROGRAM STEMS

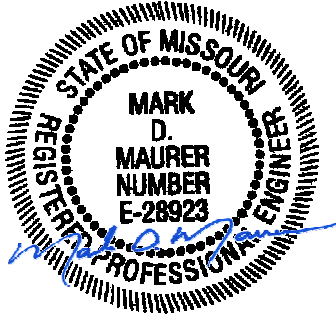
DIVISION 28

280010 GENERAL ELECTRONIC SAFETY AND SECURITY REQUIREMENTS
280501 COMMON WORK RESULTS FOR ELECTRONIC SECURITY
281010 CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

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By:



10/18/2022

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other Drawings listed on the Table of Contents page of the separately bound Drawing set titled FIRE STATION #5, CITY OF LEE'S SUMMIT, dated October 27, 2022, as modified by subsequent Addenda and Contract modifications.

END OF DOCUMENT 000115

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments are part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. A geotechnical investigation report for Project, prepared by Alpha-Omega Geotech, Inc., dated August 10, 2021, is available for viewing as appended to this Document.
 - 1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 - 2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT 003132



1701 State Avenue
Kansas City, KS 66102

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AOGeotech.com

GEOTECHNICAL ENGINEERING REPORT

FIRE STATION #5 – SITE #2

NWC OF SW LEMANS RD & SW REGATTA DR
LEE'S SUMMIT, MISSOURI
(AOG 21-126E-2)

Date: August 10, 2021

Submitted to: GLMV Architecture
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TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION	3
2.0 SUBSURFACE INVESTIGATION	3
3.0 LABORATORY TESTING PROGRAM	4
4.0 GROUNDWATER	5
5.0 GEOTECHNICAL CONSIDERATIONS	6
6.0 SITE DEVELOPMENT	6
6.1 Site Preparation	6
6.2 Undocumented Fill	7
6.3 Engineered Fill Placement	7
6.4 Drainage Considerations	7
6.5 General	8
7.0 FOUNDATIONS	9
7.1 Foundation Recommendations	9
7.2 Allowable Bearing Pressure	9
7.3 Anticipated Settlement	9
7.5 General	10
8.0 SLABS ON GRADE	10
8.1 Slab Thicknesses	10
8.2 Low Volume Change (LVC)	10
9.0 EARTH PRESSURE COEFFICIENTS	12
10.0 PAVEMENTS	13
10.1 Subgrade Preparation	13
10.2 Pavement Sections	14
10.3 Moisture conditioned & Recompacted Subgrade Sections	15
10.3.1 Flexible Pavements Sections	15
10.3.2 Rigid Pavement Sections	15
10.4 Subgrade Stabilization Sections	16
10.4.1 Chemically Stabilized Subgrade –Portland Cement	16
10.4.2 Geogrid Reinforcement & Base Rock	16
10.5 General	17
11.0 TESTING AND INSPECTION RECOMMENDATIONS	18
12.0 LIMITATIONS	19

Appendix A – SITE AND BORING LOCATION PLANS

Appendix B – LABORATORY TEST RESULTS

Appendix C – BORING LOGS





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FIRE STATION #5 – SITE #2

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Paul,

Alpha Omega Geotech, Inc. (AOG) has completed its geotechnical engineering investigation for the above-referenced project.

Attached are the following items that were utilized in the analysis and evaluation of the subsurface conditions at this site: a sketch giving the approximate location of the nine (9) auger borings completed during this investigation with reference to the existing site features; detailed laboratory results of five (5) moisture contents (ASTM D2216), five (5) dry densities (ASTM D7263); five (5) sets of Atterberg limits (ASTM D4318), and three (3) unconfined compression (ASTM D2166) tests; ten (10) calibrated pocket penetrometer readings; and nine (9) auger boring (ASTM D1452) logs that describe the materials encountered, their approximate thicknesses, and the sampling depths where Standard Penetration (ASTM D1586) tests were performed.

Representatives of AOG located each of the selected borings by measuring from the existing site features, and these measurements should be considered accurate only to the extent implied by the method of measurement. Elevations were not determined in the field at the time of drilling. Each of the borings was completed by AOG using a CME 55 high-torque drill rig.

1.0 PROJECT DESCRIPTION

Alpha Omega Geotech (AOG) understands the proposed project will consist of evaluating the site for the construction of a new fire station with associated parking and drives.

The current site covers an approximate area of 1.5 acres. It is an open grass field relatively flat with about 6-feet of elevation change.

Based on the preliminary concept information provided, the project will include a single-story building footprint of approximately 9,000 square feet. It is assumed construction will be a pre-engineered metal building with slab on grade construction. The finished floor elevation and foundation loads were not provided at this time. AOG assumes the building will be relatively lightly loaded.

Final grading plans were not provided at this time. AOG assumes cut and fill of about two (2) to three (3) feet will be necessary to achieve the desired construction grade for the site.

2.0 SUBSURFACE INVESTIGATION

Based on the information provided as well as discussions with the design team, AOG drilled nine (9) auger borings at the proposed site. The borings were advanced to their planned depths or auger refusal, whichever occurred first. Refusal depths are shown on the following table:

Table 1: Auger Refusal Depths

ROCK REFUSAL TABLE (FT)			
Boring #	Boring Location	Depth to Top of Weathered Rock	Practical Refusal Depth
1B1	See Site Sketch	~ 12.0	~ 13.8*
1B2	See Site Sketch	~ 12.0	~ 16.0*
1B3	See Site Sketch	~ 14.0	~ 14.9*
1B4	See Site Sketch	~ 20.0	NONE (20.0)
1B5	See Site Sketch	~ 15.8	~ 18.6*
1B6	See Site Sketch	NA	NONE (10.0)
1B7	See Site Sketch	NA	NONE (10.0)
1B8	See Site Sketch	NA	NONE (10.0)
1B9	See Site Sketch	NA	NONE (10.0)
(*) Very hard, weathered limestone and shale that was penetrable using our high-torque drilling equipment was encountered above the auger refusal depths shown above (see the boring logs enclosed in Appendix Section 1 of this report).			



It should be understood that the depth of boring, split-spoon refusal or auger refusal reported herein applies to the type of drilling equipment that was used. As such, it might be possible to extend some of these borings deeper using different drilling equipment and/or techniques. Conversely, residual sandstone, shale and limestone materials through which AOG's drill rig penetrated, without achieving refusal, may be difficult to excavate depending upon the equipment being used. As such, Alpha-Omega Geotech, Inc. shall not be responsible, for the determination of Others, regarding the rippability, or ease of excavation, of the in-situ subgrade, bedrock and/or geo-intermediate materials.

Above the depth, at which, boring termination occurred, predominantly silty sands were encountered in the borings. Thin-walled, steel, Shelby tube samplers (ASTM D1587) were used to collect relatively undisturbed samples from these borings for laboratory analysis. Standard Penetration tests (SPT) (ASTM D1586) were also used to sample and evaluate the consistency of the in-situ subgrade materials encountered in these test borings. Standard Penetration Tests are conducted by advancing a hollow, split spoon sampler into the base of the auger hole by means of dropping a 140-pound hammer a distance of 30 inches onto the drill rods. Each drop of the hammer is one blow, and these blow counts are recorded for each of three, 6-inch advances of the sampler. The first 6-inch advance is the seating drive, and the summation of the blow counts of the final two, 6-inch advances is taken as the standard penetration resistance. The standard penetration resistance, or N-value, as it is known, along with the soil classification, can be used to estimate the density, shear strength and other engineering properties of the materials encountered.

The N-values obtained from each of the SPT's completed in these borings using a CME automatic hammer are included on the boring logs and summarized in the Summary of Laboratory Testing sheet found in Appendix B. Samples retrieved during drilling efforts were returned to AOG's laboratory for testing and evaluation.

3.0 LABORATORY TESTING PROGRAM

Laboratory testing on materials collected during drilling was performed on samples selected by AOG. Results from these tests can be found in Appendix B and on the boring logs in Appendix C. The following laboratory tests were performed by qualified AOG personnel in accordance with ASTM specifications to determine pertinent engineering properties of the soils:

- Visual classification (ASTM D2488)
- Moisture content tests (ASTM D2216)
- Atterberg limits tests (ASTM D4318)
- Dry Unit Weight (ASTM D7263)
- Unconfined compression tests on soil (ASTM D2166)

The dry unit weights of specimens cut from the Shelby tube samples were found to be moderate, ranging from 97.1 pounds per cubic foot (pcf) to 100.8 pcf. Depending upon the material composition and depth below existing grade, the moisture content of the specimens extracted from these tube samples ranged from 23.2 to 25.8 percent. The unconfined compressive strength of the specimen cut from the Shelby tube sample ranged from 4022 to 6788 pounds per square foot (psf). It should be noted that some of the maximum unconfined compressive strength values were obtained at high strain rates nearing 10 percent. As a result, given the onsite soil types, these high strain rates typically indicate that larger settlements could occur unless a lower allowable bearing capacity value is used than otherwise indicated by the unconfined compressive strength test results. Calibrated pocket penetrometer readings



ranging from 2.5 tons per square foot (tsf) (5000 psf) to 4.0 tsf (8000 psf) were obtained on the recovered Shelby tube samples. However, it should be noted that the pocket penetrometer values tend to over-estimate the strength of in-situ subgrade materials relative to the actual unconfined compressive strength test.

The Atterberg consistency limits were determined for five, generally, representative sample taken at relatively shallow depth from within the proposed structures' footprints. Based on the Atterberg limits, the samples were classified in accordance with the Unified Soil Classification System (USCS) as Lean Clay (CL) and Fat Clay (CH) classification materials. The results of these laboratory analyses are presented in the following table:

Table #2: Atterberg Limits Results

ATTERBERG LIMITS TESTS					
Sample	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
1B1 ST-2	3.0-5.0	45	20	25	LEAN CLAY (CL)
1B2 ST-2	3.0-5.0	49	21	28	LEAN CLAY (CL)
1B3 ST-2	3.0-5.0	60	22	38	FAT CLAY (CH)
1B4 ST-2	3.0-5.0	57	22	35	FAT CLAY (CH)
1B5 ST-2	3.0-5.0	47	21	26	LEAN CLAY (CL)

Based on the Atterberg limits, it is anticipated most of the onsite soil materials generally possess a moderate to high swelling potential. The swelling potential of a clay soil is an indication of the volume changes that may take place with variations in the soil moisture content.

Except for the samples for which the Atterberg limits were determined, all of the other soil classifications given throughout the laboratory test data, as well as, the boring logs, were made using the visual and tactile techniques described in ASTM D2488. As a result, additional analyses could reveal other soil types of different classification and potentially higher plasticity and swelling potential both onsite and within the nearby vicinity.

4.0 GROUNDWATER

Free water was encountered at about 18.3 fbg in boring 2B4. Free water was not encountered in any of the remaining borings at the time of drilling. However, a twenty-four-hour water level was not established in these borings due to time restrictions, as well as, potential safety hazards associated with open bore holes.

Although the ground water levels given on the boring logs reflect the conditions observed at the time the borings were made, they should not be construed to represent an accurate or permanent condition. There is uncertainty involved with short-term water level observations in bore holes especially in clay soils of relatively low permeability. The groundwater level should be expected to fluctuate with variations in precipitation, site grading and drainage conditions. In addition, it is also possible that seasonal perched ground water may be encountered within these soil deposits and bedrock formations at different depths during other times of the year based on drainage conditions, seasonal snowmelt and rainwater infiltration.



5.0 GEOTECHNICAL CONSIDERATIONS

The following considerations are given based on observations made by AOG at the time of drilling, during reconnaissance trips, and based on the project requirements and description as stated above:

- 1) **Expansive Materials:** Expansive clays were encountered during this exploration. Expansive clays are known to experience significant volume changes with changed in moisture. Expansive clays located beneath any slabs on grade should be removed in accordance with Section 8.0, "SLABS ON GRADE," of this report.

6.0 SITE DEVELOPMENT

6.1 Site Preparation

Based on the information provided, AOG anticipates amounts of cut and fill, two (2) to three (3) feet +/-, from the current elevation within the proposed structure footprint will be required to achieve finish floor elevations. It is possible that additional cuts and fills may be required to obtain improved surface drainage.

Appropriate erosion control measures, such as proper site contouring during grading activities, as well as silt fences, should be maintained to help keep any eroded materials onsite.

Within the footprint of the proposed new structure and associated paving, it is recommended that any topsoil, vegetation, utility backfill, and other deleterious material (i.e. concrete slabs, relic foundations, utilities, etc.) or pavements should be stripped and removed prior to the placement of any fill required to achieve the finished floor elevation.

Transitions between cuts and fills should be on slopes of 5:1 (H:V), or flatter, and will require proper benching. Additionally, any placement of engineered fill on existing slopes will require proper benching with the native clay soils during placement.

In accordance with the local building code, the exposed subgrade and any benching required during fill placement must be verified by a representative of Alpha-Omega Geotech, Inc. prior to the placement of fill.

Once initial site stripping operations have been completed and prior to the placement of any engineered fill in this area, it is recommended that the exposed subgrade be moisture conditioned and recompact, as needed, and be thoroughly evaluated by means of a proof-roll with a fully loaded, tandem-axle dump truck to locate any soft, compressible areas within the proposed project site. Any soft, compressible areas identified on the proposed project site must be corrected by over-excavation to a suitable subgrade and replaced with an acceptable material. Although it is not typically anticipated that any extensive removal and replacement would be necessary, it is possible that some effort may be required to develop a stable platform on which to place the necessary fill material and address any other existing site conditions that become known during construction. It is generally anticipated that the extent of these efforts would strongly depend upon the ground moisture conditions at the time the site work begins. In the event that the ground is generally dry, it is possible that only a minimal amount of stabilization would be required, which may be possible to accomplish by simple moisture conditioning and recompaction efforts. *Nevertheless, it is recommended that a representative of Alpha-Omega Geotech, Inc. should be onsite to witness this proof-rolling and offer recommendations, as needed, to correct any problem areas identified.*



6.2 Undocumented Fill

Undocumented fill is a foreign material, of which no records of testing or evaluation by a qualified professional during the time of placement exist. The risks associated with supporting foundations and floor slabs on undocumented fill include total and differential settlements in excess of tolerable limits. Undocumented fill was not encountered during this exploration. If undocumented fill is encountered during construction, it should be addressed in accordance with this report.

Undocumented fill is, generally, unsuitable beneath structures and pavements, and, if encountered during development, should be completely removed and replaced with engineered fill.

6.3 Engineered Fill Placement

It is assumed that any fill material needed will come from cut areas and, if necessary, on-site or nearby borrow sources of similar material. It is recommended that silts and any unweathered shales should NOT be used to construct any of the necessary fill within either the new building or paved portions of the site. Assuming they are properly moisture conditioned and compacted, it generally appears that the clean clay soils encountered in the borings that are free of rubble, trash, concrete, asphalt, and other debris would be acceptable for use as controlled fill. However, due to their very high swelling potential, detailed recommendations for the placement of a non-expansive subbase are provided in Section 8.0, SLABS ON GRADE of this report.

Any imported fill materials for use as structural fill should be tested by Alpha-Omega Geotech, Inc. to determine if they are acceptable for the intended use. Any groundwater seeps that are encountered must be diverted prior to placing fill.

In addition, no compaction of soil fill material should be performed during freezing weather. Nevertheless, as weather conditions dictate, it may be possible to substitute crusher-run limestone in lieu of soil fill to allow placement of engineered controlled fill material to continue during the cold fall and winter months. However, any frozen fill material must be stripped prior to placing subsequent lifts.

All general fill within the area of the new structure (except for the upper 24-inches, as discussed in Section 8.0, SLABS ON GRADE of this report) should be placed in lifts not exceeding 6 inches in thickness, and compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within ± 3 percent of the optimum moisture content.

As required by the local building code, the compaction of any structural fill beneath the new buildings, pavements, and any other areas where settlement control is necessary, as well as any slopes that are steeper than 4:1 (H:V), should be tested lift-by-lift by a representative of Alpha-Omega Geotech, Inc.

6.4 Drainage Considerations

Fluctuations of the groundwater level can occur due to seasonal variations in the amount of rainfall and other climatic factors that were not evident at the time the borings were made. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. In spring and late fall, soil moisture contents may be abnormally high and drying of the soils that are exposed and/or undercutting



may be required to develop a suitable base for the placement and compaction of engineered fill. Disking and aeration of the exposed soils may be sufficient to develop a stable base. However, if site grading begins during the summer or early fall, moisture contents may be abnormally low and the plastic clay soils encountered during this exploration may undergo significant volume changes with subsequent increases in their moisture content. Therefore, when these conditions exist, disking and moisture conditioning of the exposed subgrade soils may be required.

It is important to consider drainage and construction elements that will help to inhibit future slab on grade problems, foundation cracks, as well as intolerable settlements due to volume changes of the onsite soils. The surface drainage must be designed to prevent ponding and effectively move water away from both the new and existing buildings, pavements and other structures. It is also very important to place all materials under carefully controlled conditions of moisture and density to inhibit significant soil volume changes. Shrubs and trees with deep root systems and requiring large quantities of water should not be planted within 20 feet of the building lines. Any planters located near the building should have impermeable bases with weep holes to discharge water away from the wall lines. Down spouts should be connected to subsurface drains to carry the water to safe exits beyond the building lines, retaining walls, pavements, slopes and other site features or structures that could be adversely affected by water seepage.

In addition to controlling surface drainage, it is recommended that a gravity drainage system, such as a French drain or similar, designed to intercept free water prior to contact with foundations be installed in areas where the topography will direct water toward the proposed structure. foundation drainage systems should, also, be considered to prevent any free water accumulation and/or ingress at the foundations where shallow groundwater was encountered. Any basement or below grade slabs should have a permanent dewatering system, such as a sump pump or similar type system, installed to alleviate and water accumulation.

6.5 General

Permanent slopes should not be steeper than 3:1 (H:V) to help ensure their future stability and accommodate normal mowing equipment. The responsibility for excavation safety and stability of temporary construction slopes should lie solely with the contractor and should follow the OSHA regulations given in 29 CFR Part 1926.650 - .652, Subpart P. The stability of open excavations is dependent upon a number of factors including but not limited to the presence of gravel, sand and/or silt seams, groundwater seepage, strength characteristics of the soil layers, slickensides and other unique geological features, the slope and height of the cut, surcharge loading and vibrations during construction, weather conditions, as well as the length of time the excavation is left open. Alpha-Omega Geotech, Inc. does not assume any responsibility for construction site safety or the contractor's or other parties' compliance with all local, state and federal safety or other regulations including imprudent excavating practices that results in any damage to nearby structures, roadways, utilities, as well as onsite or offsite improvements.



7.0 FOUNDATIONS

7.1 Foundation Recommendations

Based on the finding during this geotechnical exploration and AOG's understanding the proposed project, it is AOG's opinion that a shallow foundation system consisting of either earth-formed trench or spread footings may be used as economical foundation elements.

Based on the subsurface conditions that have been identified, Site Class C conditions (IBC 2015) may be assumed for seismic consideration.

Perimeter footings, and any footings in unheated areas, should be placed at least 3 feet below final exterior grade to provide adequate frost protection and place them in a more stable moisture environment. Under heated areas, the interior footings can be founded at shallower depths of at least 18 inches below the finished floor elevation. The footing excavations should be carried to undisturbed, inorganic soil or engineered fill.

7.2 Allowable Bearing Pressure

Provided all design and inspection recommendations as given in this report are closely followed and good construction practices are exercised, it is recommended an allowable bearing value of 2,000 psf may be used for design purposes to proportion the spread/wall footings. A twenty-percent increase, i.e. 2,400 psf, may be used for individual column footings. These allowable bearing capacity values, which are based on shear strength alone and not on settlement, incorporate a factor of safety of 3.0. The actual bearing capacity of all subgrade supporting the foundation elements must be confirmed by a representative of Alpha-Omega Geotech, Inc. as the excavations for the load-bearing wall and column footings are completed and prior to placement of reinforcing steel and concrete. For transient loading conditions, such as unsustained wind and earthquake, a 33 percent increase may be applied to the above-referenced allowable bearing capacity values.

7.3 Anticipated Settlement

Uniform bearing conditions should be provided beneath the footings to minimize differential settlements. If any soft or otherwise unsuitable material is encountered in the footing excavations, it will have to be removed and replaced with engineered controlled fill. Recommendations for the over-excavation and replacement with engineered controlled fill can be made when the footing excavations are inspected during construction, if needed. A representative of Alpha-Omega Geotech, Inc. should inspect all of the footing excavations to verify that uniform and competent bearing material is present beneath all of the foundation elements prior to the placement of any reinforcing steel and concrete.

For spread footings designed and constructed in accordance with this report, it is anticipated that settlements will be limited to 0.75 inches of differential and 1.0 inches in total.



7.5 General

If possible, the over-dug footing excavations should not be left open for more than 24 hours to help reduce excessive sloughing, softening or drying of the exposed subgrade material. The base of the footing excavations should be free of water and loose soil prior to placing reinforcing steel and concrete. No groundwater is expected in the footing excavations since groundwater was not encountered in any of the borings that were made at the time of drilling. However, if groundwater is encountered within the expected depth of excavation for the footings, it is anticipated that it can be removed by the use of sumps and pumps. Based on the subsurface conditions that have been identified, it is anticipated that earth-formed trench footing excavations may be used effectively on this project. A minimum width of 12 inches should be used for trenched wall footings to allow for steel placement and inspection. Minimum widths of 16 and 24 inches should be used for formed wall and column footings, respectively.

8.0 SLABS ON GRADE

8.1 Slab Thicknesses

Slabs on grade that will be subjected to repeated wheel loads, such as passenger vehicles, should be at least 6 inches in thickness. Slabs that are not exposed to repeated wheel loads, should be at least 4 inches in thickness. Slabs in storage areas may need to be thicker due to shelving post and other concentrated floor loads. The final slab design thickness should be determined by the project structural engineer.

8.2 Low Volume Change (LVC)

The following recommendations are provided to help protect the slabs from damage caused by volume changes within the underlying subgrade, and should be implemented in conjunction with Section 7.0, FOUNDATIONS of this report:

- 1) Cut the subgrade a minimum of 24-inches beneath the base of slab elevation to allow placement of a 20-inch subbase and a 4-inch base course beneath the slab-on-grade.
- 2) Scarify and recompact the upper 9 inches of exposed subgrade to within 95 to 100 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content wet of the optimum moisture content 0 to 3 percent.
- 3) For the 20-inch granular subbase, place crusher-run limestone or rock dust in three (3) equal lifts and compact to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density. The moisture content of this material at the time of placement must be sufficient to achieve the specified level of compaction.
- 4) Place a 4-inch base course of clean, open-graded crushed limestone. This granular base course should be compacted with a suitable vibratory steel wheel roller.

Alternatively, it would be possible to consider constructing the 20-inch subbase (in addition to the above recommended 4-inch base course) by chemically stabilizing the onsite expansive clay soil material with Portland cement blended at 5 percent, by weight using a large Bomag Tiller. However, due to the amount of dust that is generated, the use of these materials may not be a viable alternative for this project site. In addition, it should also be noted that chemical stabilization is, generally, only effective when the ground temperature is a minimum of 50° to 60°F. Nevertheless, if this alternative is utilized, the stabilized subbase should be placed in three (3) equal lifts



and compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within ± 3 percent of the optimum moisture content. Compaction of the supplemented soil should be completed within one hour after incorporation. Additional compaction after two hours could cause degradation of the soil strength.

Please note, when constructing in areas where clays are present, the owner should recognize there is an inherent risk of distress associated with volume changes of the soil, even with subgrade removal and/or treatment.

8.3 General

It is recommended that under-slab utility trenches should be backfilled with impermeable clay soil (*), flowable fill or lean concrete to help reduce the potential of these trenches acting as aqueducts transmitting groundwater beneath the new building, pavements, retaining walls and other structures.

- (*) If impermeable clay soil is used as backfill, it should be placed in lifts not exceeding 6 inches in thickness and compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within ± 3 percent of the optimum moisture content, which should be verified lift-by-lift during placement by a representative of Alpha-Omega Geotech, Inc. Although clay soil may be less costly than flowable fill or lean concrete, the OSHA excavation safety regulations given in 29 CFR Part 1926.650 - .652, Subpart P must be followed in the event that clay soil is used to backfill any utility trenches.

Finally, it should be noted that the recommendations given, herein, regarding placement of low-volume change fill to help protect the slabs on grade from volume changes associated with fluctuations within the moisture content of the underlying subgrade materials, would still apply.

Plumbing lines and other water leaks occurring beneath the structure's slab-on-grade floor can induce volume changes within the underlying subgrade materials. Therefore, it is recommended that all water supply and waste water lines should be tested for leaks prior to backfilling the utility trenches. In addition, it is also recommended that every effort should be made to maintain the plumbing in good working order and prevent or minimize water leaks and discharges.

It is assumed the concrete will be reinforced with properly placed steel reinforcement, such as #4 bars, and control joints will be cut during or shortly after finishing (to be designed by the project structural engineer). Properly placed wire mesh may be used as secondary reinforcement. Fiber reinforcement may also be considered to help control shrinkage cracking and the use of other admixtures may be considered to enhance the workability and performance of the concrete. Suitable construction and sawed joints should be used to control cracking of the slab. In addition, it is recommended that the slump and temperature of the concrete at the time of placement should be limited to standard American Concrete Institute (ACI) guidelines. Furthermore, it is also recommended that proper concrete curing techniques should be utilized and the addition of jobsite water to the concrete be avoided or very closely controlled to within acceptable parameters. Nevertheless, it should be noted that cracking of concrete used for slabs on grade is a normal occurrence and should be expected.



If a 20-inch thick subbase layer of crusher-run limestone (AB-3) or rock dust is used, as recommended, a modulus of subgrade reaction of 150 pci may be assumed for reinforcement and thickness design to support surface loads. If a higher modulus of subgrade reaction were desired, we would be pleased to work with the project's structural engineer to develop recommendations for alternate bases and/or subbases to achieve a higher modulus of subgrade reaction.

9.0 EARTH PRESSURE COEFFICIENTS

A coefficient of sliding friction over the in-situ clay soils at this site may be taken as 0.32. A minimum factor of safety of 1.5 should be used when considering sliding resistance.

Active, passive and at-rest earth pressure coefficients of 0.25, 4.2 and 0.4 may be assumed for backfills of clean, open-graded crushed limestone.

Active, passive and at-rest earth pressure coefficients of 0.5, 1.9 and 1.0 may be assumed for the in-situ clay soils at this site.

However, some of the in-situ soils encountered during this exploration are classified as a Fat Clay and possess a high swelling potential, and, as such, should not be used as backfill since considerable lateral loads may develop with the addition of water.

If deflection of extended foundation walls or retaining walls is not tolerable, at rest earth pressures should be assumed.

These earth pressure coefficients do not include the effect of surcharge loads, hydrostatic loading or a sloping backfill nor do they incorporate a factor of safety. Also, these earth pressure coefficients do not account for high lateral pressures that may result from volume changes when expansive clay soils are used as backfill behind walls with unbalanced fill depths. In addition, any disturbed soils that are relied upon to provide some level of passive resistance should be placed in lifts not exceeding 6 inches in thickness and compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within ± 3 percent of the optimum moisture content. It is recommended that a representative of Alpha-Omega Geotech, Inc. should verify the compaction of any such materials relied upon to provide passive pressure lift-by-lift during placement.



10.0 PAVEMENTS

10.1 Subgrade Preparation

Please note, a formal pavement design is beyond AOG's scope of service. Standard asphaltic concrete and Portland concrete pavement designs for a given service life requires evaluation of the soil by means of a California Bearing Ratio (CBR) test and/or other methods, estimates of traffic volumes and axle weights, drainage requirements and the desired level of maintenance. As such, some standard pavement design options based on assumptions made for materials of this nature are included in this section.

The subgrade soils at this site are considered to be poor subgrade materials for the support of pavements. California Bearing Ratio (CBR) values we have obtained rarely exceed 5, soaked, for these materials. Pavements, either total strength flexible or rigid, do not usually perform well when they are placed directly on highly expansive, poor soil subgrades. Soft areas can develop during wet periods and differential shrinkage can occur during dry periods. As a result, no pavement can avoid damage from wheel loads under these circumstances.

Unless the subgrade is stabilized, the subgrade for all pavements should consist of at least 12 inches of properly moisture conditioned and compacted soil, which will require tilling and recompact in cut sections. The subgrade should be compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within ± 3 percent of the optimum moisture content. Any additional fill that is required to develop the paved areas should also be placed in loose lifts not exceeding 8 inches in thickness and compacted in accordance with these recommendations. It is recommended that any and all subgrade operations including recompact subgrades, compacted aggregate bases or chemically stabilized subgrade layers should extend at least 2 feet beyond the pavement and curb lines.

Prior to the placement of any pavement section, the exposed subgrade should be proof-rolled with a fully loaded, tandem-axle dump truck after the final subgrade elevation has been established throughout the paved area. A representative of Alpha-Omega Geotech, Inc. should witness this proof-rolling.

Please note, if asphaltic pavements are used, annual maintenance including but not limited to crack sealing, fog sealing, and possible patch with overlay should be anticipated. In addition, the quality of the aggregates and overall composition of the asphalt or concrete mix, as well as drainage conditions, can have a profound effect upon the durability of the pavement section.



10.2 Pavement Sections

Table 3: Recompacted Subgrade Section

RECOMPACTED SUBGRADE SECTIONS (INCHES)			
PAVEMENT MATERIALS	PASSENGER VEHICLE PARKING	PASSENGER VEHICLE DRIVE LANES	HEAVY DUTY AREAS (i.e. Dumpster pads, approach lanes, etc.)
Asphaltic Surface Course	2	2	NA
Asphaltic Base Course	3	5.5	NA
Moisture Conditions/Recompacted Subgrade	12	12	NA
Portland Cement Concrete	5	7	8
Crushed Stone Base (3/4-inch minus)	4	4	4
Moisture Conditions/Recompacted Subgrade	12	12	12

*Reference Section 10.3, "Recompacted Subgrade Sections"

Table 4: Recommended Thicknesses with Chemically Stabilized Subgrade

CHEMICALLY STABILIZED SUBGRADE SECTIONS (INCHES)			
PAVEMENT MATERIALS	PASSENGER VEHICLE PARKING	PASSENGER VEHICLE DRIVE LANES	HEAVY DUTY AREAS (i.e. Dumpster pads, approach lanes, etc.)
Asphaltic Surface Course	2	2	NA
Asphaltic Base Course	2	4	NA
Chemical Stabilization	12	12	NA
Portland Cement Concrete	4	6	7
Crushed Stone Base (3/4-inch minus)	4	4	4
Chemical Stabilization	12	12	12

*Reference Section 10.4.1, "Chemically Stabilized Subgrade"

Table 5: Recommended Thicknesses with Geogrid Reinforcement & Baserock

GEOGRID REINFORCEMENT AND BASEROCK SUBGRADE STABILIZATION SECTIONS (INCHES)			
PAVEMENT MATERIALS	PASSENGER VEHICLE PARKING	PASSENGER VEHICLE DRIVE LANES	HEAVY DUTY AREAS (i.e. Dumpster pads, approach lanes, etc.)
Asphaltic Surface Course	2	2	NA
Asphaltic Base Course	2	4	NA
Geogrid & Crushed Stone (3/4-inch minus)	6	6	NA
Portland Cement Concrete	4	6	7
Geogrid & Crushed Stone (3/4-inch minus)	6	6	6

*Reference Section 10.4, "Subgrade Stabilization Sections"



10.3 Moisture conditioned & Recompacted Subgrade Sections

10.3.1 Flexible Pavements Sections

From an initial cost perspective, flexible asphaltic concrete pavement is the most economical pavement section. However, treating the subgrade with Portland cement or using a geogrid reinforced base course can provide a higher quality pavement section, having a much longer service life. Nevertheless, if the subgrade is untreated and asphaltic pavement is used, areas used exclusively for automobile parking should consist of at least 5.0 inches of asphaltic concrete (2.0 inches of surface mix and 3.0 inches of base mix). Drives should be constructed of at least 7.5 inches of asphaltic concrete (2.0 inches of surface and 5.5 inches of base mix).

The above-referenced pavement section represents minimum design thicknesses and, as such, periodic maintenance should be anticipated. If an increased pavement performance is desired, as described in Section 10.4, "Subgrade Stabilization," Portland cement stabilization or the use of a layer of base rock and geogrid reinforcement should be considered. Asphaltic cement concrete should NOT be used in areas where heavy truck loads/concentrations are expected.

It is also recommended that an asphalt binder grade of PG 64-28 should be considered to help reduce the potential of thermal cracking based on the climatic conditions of this region. However, for base mix asphalt placed at least 4 inches below the surface, an asphalt binder grade of PG 64-22 should be sufficient.

10.3.2 Rigid Pavement Sections

As an alternative, rigid Portland Cement concrete with a 4-inch thick base course of crushed limestone may also be used with minimum thicknesses of 5.0 and 7.0 inches for automobile parking areas and drive lanes, respectively. The above-referenced pavement section represents minimum design thicknesses, and as such periodic maintenance should be anticipated. If a better pavement is desired, recommendations as described in Section 10.4, "Subgrade Stabilization Sections," should be considered.

The crusher-run limestone base course should be compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content sufficient to achieve the specified level of compaction.

For areas where heavy truck loads/concentrations are anticipated, Portland Cement concrete is recommended. Portland cement concrete slabs having a thickness of 8 inches over a 4-inch, minimum, compacted, crusher-run limestone base should be used for dumpster stations, parking lot entrances, areas where a high concentration of heavily loaded trucks are anticipated, as well as any areas where trucks accelerate/decelerate and execute sharp turning maneuvers.



10.4 Subgrade Stabilization Sections

Alternate pavement sections utilizing Portland cement stabilization, geogrids and granular base and/or subbase courses should be considered. Treating the subgrade with Portland cement or using a geogrid reinforced base course can provide a pavement section having a much longer service life.

If specific pavement performance standards are to be met, AOG would be pleased to be of further assistance once the actual design loading conditions, service-life and maintenance expectations have been defined.

10.4.1 Chemically Stabilized Subgrade –Portland Cement

The use of Portland cement is usually not effective during cold winter months. Notwithstanding this weather limitation, assuming the cement is thoroughly and uniformly mixed with the subgrade, cement stabilization can greatly reduce the swelling potential and improve the strength of the subgrade soil.

Chemically treated subbases, Portland cement stabilization, should be extended to a depth of 12 inches.

For a chemically treated subbase, full depth asphalt pavements with thicknesses of 4.0 and 6.0 inches for parking and drive lanes, respectively, can be used. Likewise, if the subgrade is chemically stabilized, the Portland cement concrete pavement sections over a 4-inch thick base course of crushed limestone may also be reduced to 4.0 and 6.0 inches, respectively.

The crusher-run limestone base course should be compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content sufficient to achieve the specified level of compaction.

It is usually cost effective to determine the optimum amount of Portland cement necessary by laboratory testing; however, it usually ranges from about 5 to 6 percent by weight for Portland cement. The Portland cement should be thoroughly mixed with the subgrade soil by means of a Bomag tiller or other similar equipment specifically designed for such procedures and compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within ± 3 percent of the optimum moisture content.

10.4.2 Geogrid Reinforcement & Base Rock

Soft areas can develop even when the subgrade is chemically stabilized. An even better pavement section can be developed by the use of a tri-axial geogrid over a properly compacted subgrade, as discussed in this report, and a layer of untreated crushed limestone base rock under either flexible or rigid pavements. The purpose of the geogrid is to help span soft spots that will inevitably develop in the subgrade. The geogrid helps to confine the base rock and acts as a "snowshoe," distributing the loads over the subgrade in a tri-axial direction. The layer of base rock, which is placed over the geogrid, must be thick enough to support construction traffic and paving equipment so the geogrid does not become exposed. In general, the crushed limestone base rock should not be less than approximately 6 inches in thickness. If this option is chosen, it is recommended that Tensar TX-140, which is a tri-axial polypropylene geogrid, be used. The geogrid reinforcement should be placed and overlapped as needed in accordance with the manufacturer's recommendations, which should be verified by a representative of Alpha-Omega Geotech, Inc.



Asphaltic concrete thicknesses of 4.0 and 6.0 inches for parking areas and drive lanes, respectively, can be used if geogrid and base rock stabilization are used. Similarly, the Portland cement concrete sections can be reduced to 4.0 and 6.0 inches for the respective areas. Although these thicknesses are the same as given if the subgrade is treated with cement, the use of a tri-axial geogrid and base rock usually represents the most effective, reasonable pavement section.

10.5 General

If asphaltic pavements are used, periodic maintenance including, but not limited to, crack sealing, fog sealing, and possible patch with overlay should be anticipated. In addition, the quality of the aggregates and overall composition of the asphalt or concrete mix, as well as drainage conditions, can have a profound effect upon the durability of the pavement section.

Where engineered controlled fill is placed beneath paved areas, it is recommended the compacted fill should extend a minimum distance of two (2) feet beyond the pavement edge or curb line, or a distance equal to the depth of the fill, whichever is greater.

Asphalt mixes meeting KDOT BM-2 and BM-2B specifications may be used for surface and base mixes, respectively. Compaction testing of each pavement layer is recommended to help ensure compliance with the mix design specifications.

For areas where heavy truck loads/concentrations are anticipated, rigid concrete is should be used. It is recommended that load-transfer devices should be installed where construction joints are required. For dumpster stations, the concrete slabs should be large enough to accommodate the dumpster and at least the rear wheels of the disposal vehicle. Rigid pavements should have No. 4 bars on at least 2-foot centers and positioned in the upper third of the slab. Joints should be tooled or cut within 4 hours of hardening to a depth of at least one fourth of the thickness.

The subgrade should be moistened prior to placement of concrete. Fresh concrete should be properly cured as recommended by the American Concrete Institute (ACI). To help provide resistance to damage caused by alternating cycles of freezing and thawing, it is recommended that any exposed concrete should be properly air entrained; typically at 5 to 7 percent. In addition, it is also recommended the outer edges of pavement slabs should be thickened to help resist cracking associated with heavy wheel loads near these unrestrained areas.

If full-depth pavement is used, it is important the moisture content of the subgrade should be kept as constant as possible from the time of recompacting until the pavement is laid. However, if the subgrade becomes dry, it should be moistened for at least 72 hours prior to paving, but it should not be saturated. In all cases, pavements should be sloped to inhibit ponding and provide rapid surface drainage. If water is allowed to pond on or adjacent to the pavement, the subgrade could become saturated and lose its bearing capacity which would contribute to premature pavement deterioration under a single cycle of heavy wheel loads or a number of cycles of lighter wheel loads.



11.0 TESTING AND INSPECTION RECOMMENDATIONS

Unless Alpha-Omega Geotech, Inc. is retained to provide the construction observation, monitoring and testing services for this project, we cannot accept any responsibility for any conditions that deviate from those identified in this subsurface investigation nor for the performance of the foundations, pavements and other structures including any retaining walls that are a part of this project. Alpha-Omega Geotech, Inc. is accredited by AASHTO and we are experienced in construction quality control and have a fully-equipped soil, concrete, aggregate, rock and asphalt testing laboratory, as well as qualified field technicians to provide these field services.

It is not economically practical to perform enough exploratory borings on any site to identify all subsurface conditions. Some conditions affecting the design and/or construction may not become known until the project is underway. The boring logs, field SPT and laboratory test results depict subsurface conditions only at the specified locations and depths at the site. The boundaries between soil and rock layers indicated on the boring logs are based on observations made during drilling and an interpretation of the laboratory testing results. The exact depths of these boundaries are approximate and the transitions between soil and rock types may be gradual rather than being clearly defined. Also, due to the prior development at this site, as well as the natural conditions of the formation of soils and rock, it is possible that unanticipated subsurface conditions may be encountered during construction. Monitoring of the subsurface conditions that are revealed during construction is needed to verify that subsurface conditions are consistent with those conditions identified in this preliminary geotechnical investigation. If variations in subsurface conditions are encountered, it will be necessary for Alpha-Omega Geotech, Inc. to re-evaluate the recommendations that have been made in this report.

Special Inspections should be performed in accordance with the local building code under which the project is designed, as adopted by Lee's Summit, MO.

Prior to filling, it is recommended that a representative of Alpha-Omega Geotech, Inc. should verify that the site has been properly stripped of all topsoil and other deleterious material, benched as needed and prepared for the placement of fill. The compaction of any structural fill beneath the new building, pavements, and any other areas where settlement control is necessary should be tested lift-by-lift by a representative of Alpha-Omega Geotech, Inc. as it is being placed. This should include the prepared subgrade layers beneath the building's slab-on-grade, as well as any other fill material relied upon to provide passive resistance. Also, in accordance with the local building code, any fill that is used to construct slopes steeper than 4:1 (H:V) must be placed as engineered controlled fill and the compaction tested lift-by-lift during placement.

Assuming that uniform fill material is used, nuclear density gauges (ASTM D2922/D3017) should be used to test compaction wherever necessary. However, if fill material of non-uniform consistency is used, other evaluation methods may be required. Such methods may include, but not be limited to, the use of a GeoGauge Stiffness meter, Dynamic Cone Penetrometer (DCP), proof-rolling or other visual inspection techniques.

Any geotextile fabric and geogrid reinforcement that is utilized should be placed and overlapped as needed in accordance with the manufacturer's recommendations, which should be verified by a representative of Alpha-Omega Geotech, Inc. Proper placement of the reinforcing steel for drilled piers, grade beams, pier caps, foundation walls and other structural elements including any necessary wing walls and retaining walls should be verified prior to the placement of concrete. The subgrade under the slabs on grade and pavements should be checked to verify they are in compliance with the density and moisture requirements. Wherever possible, in addition to compaction



testing, cut and fill areas should be proof-rolled with a loaded tandem-axle dump truck to identify soft areas that will need to be corrected. A representative of Alpha-Omega Geotech, Inc. should observe this proof-rolling. Checks should also be made of the subbases, concrete and any pavement materials.

Finally, the inspection and testing services listed herein are given as a minimum and it should be understood that additional inspection and testing services might also be required or otherwise beneficial.

12.0 LIMITATIONS

This report is presented in broad terms to provide a comprehensive assessment of the interpreted subsurface conditions and their potential effect on the adequate design and economical construction of the proposed new Fire Station project located in Lee's Summit, Missouri, as discussed herein. This report has been prepared for the exclusive use of our client for specific application to the project discussed herein and has been prepared within our client's directive and budgetary constraints and in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

It should be noted that the concept of risk is an important aspect of the geotechnical engineering evaluation and report since the recommendations given in this report are not based on exact science but rather analytical tools and empirical methods in conjunction with engineering judgment and experience. Therefore, the recommendations given herein should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soil materials and the proposed structures will perform as planned. Nevertheless, the geotechnical engineering recommendations presented herein are Alpha-Omega Geotech, Inc.'s professional opinion of those measures that are necessary for the proposed structures to perform according to the proposed design based on the information provided to Alpha-Omega Geotech, Inc., the referenced information gathered during the course of this investigation and our experience with these conditions.

Any significant structural changes to the proposed new structure or its location on this site relative to where these test borings were completed shall be assumed to invalidate the conclusions and recommendations given in this report until we have had the opportunity to review these changes and, if necessary, modify our conclusions and recommendations accordingly. It is also strongly suggested that Alpha-Omega Geotech, Inc. should review your plans and specifications dealing with the earthwork, foundations, as well as any pavements prior to construction to confirm compliance with the recommendations given herein. Particular details of foundation design, construction specifications or quality control may develop, and we would be pleased to respond to any questions regarding these details.

If Alpha-Omega Geotech, Inc. is not retained to review the project plans and specifications, address to the proposed building and parking structure or their location on the site relative to where these test borings were completed, provide the recommended construction phase observation, monitoring and testing services and respond to any subsurface conditions that are identified during construction to evaluate whether or not changes in the recommendations given in this report are needed, we cannot be held responsible for the impact of those conditions on the project or the future performance of the buildings, pavements and/or structures that may be involved.

The scope of our services did not include any environmental assessment or investigation for the presence of hazardous or toxic materials in the soil, surface water, groundwater or air, either on, below or adjacent to this site. In addition, no determination regarding the presence or absence of wetlands was made. Furthermore, it should be



understood that the scope of geotechnical services for this project does not include either specifically or by implication any biological (i.e. mold, fungi or bacteria) assessment of the site or the proposed construction. Any statements in this report or included on the boring logs regarding odors, colors and unusual or suspicious items or conditions are strictly for informational purposes only.

We appreciate the opportunity to be of service to GLMV Architecture, as well as the project developers, and look forward to working with you throughout the construction process. We are prepared to provide the Special Inspection services that will be required by the local building code under which this project is designed, as adopted by the City of Lee's Summit, MO, as well as the other necessary construction observation, monitoring and testing services discussed in this report. If you have any questions concerning this report, or if we may be of further assistance, please call us at (913) 371-0000.

Sincerely,
ALPHA-OMEGA GEOTECH, INC.



Garic Abendroth, P.E.
Director of Engineering

Enclosures

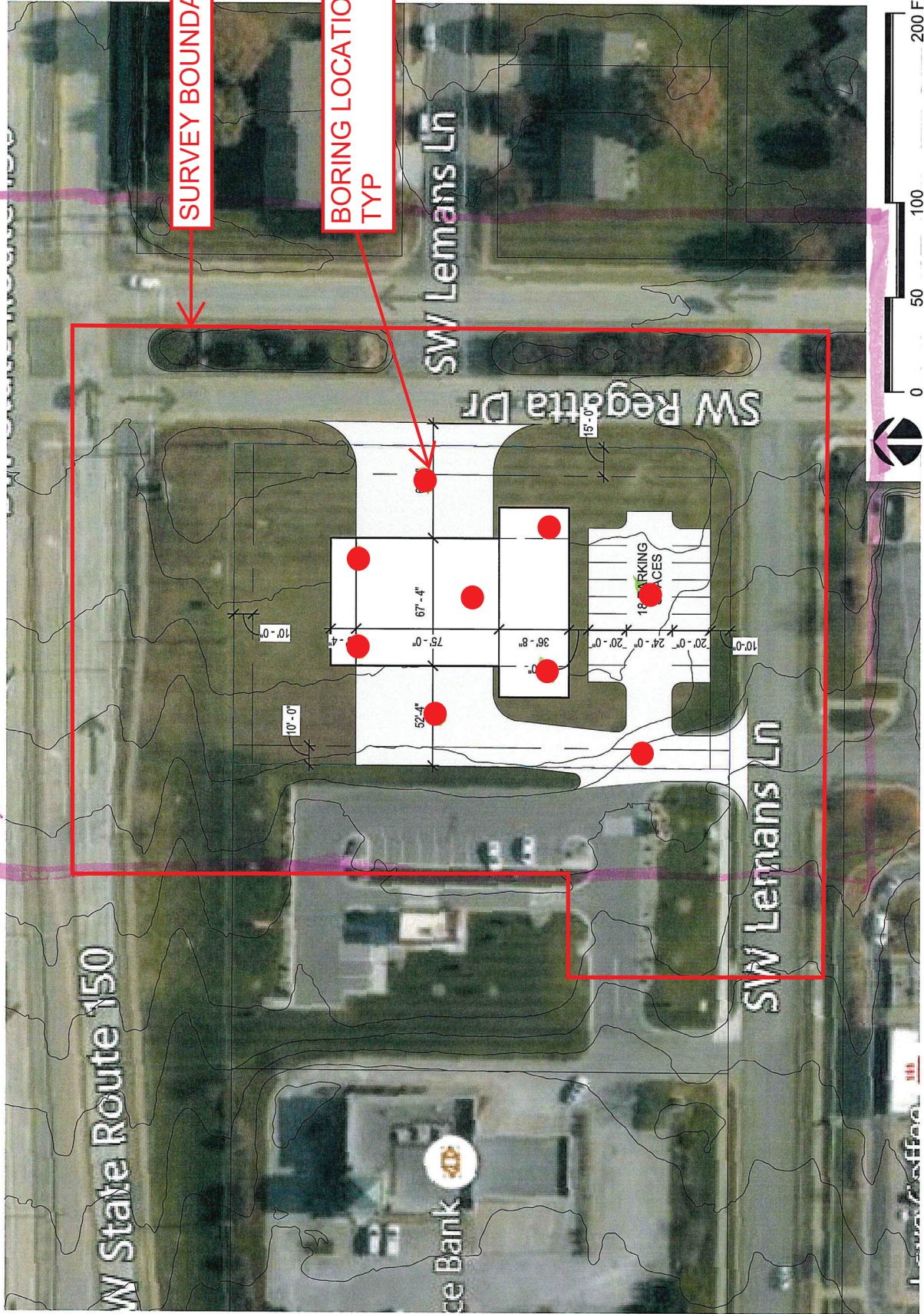


Appendix Section A

SITE SKETCH

Site and Boring Location Plans

FIRE STATION #5



SURVEY BOUNDARY

BORING LOCATION
TYP

Fire Station #5 - Site #2

Legend



Appendix Section B

LABORATORY TEST RESULTS

Summary of Laboratory Testing

SLT 22205

Alpha-Omega Geotech, Inc.

1701 State Avenue
Kansas City, KS 66102
Office: (913) 371-0000 Fax: (913) 371-6710
Website: www.aogeotech.com



PROJECT NAME:

FIRE STATION #5 - SITE #2

PROJECT NUMBER:

21-126E-2

PROJECT LOCATION:

LEE'S SUMMIT, MO

DATE:

8/10/2021

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL PL PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression (psf)	%e	% Swell	Remarks
2B1	ST-1	1.0-3.0	Brown FAT CLAY				CH					PP=4.0
2B1	ST-2	3.0-5.0	Brown, speckled dark brown LEAN CLAY	23.2	100.8	45 20 25	CL		4449	7.3		PP=2.75
2B1	SS-3	8.5-10.0	Brown, spotted reddish brown and dark brown FAT CLAY				CH					N=10
2B1	SS-4	13.5-13.8	No recovery - Sandstone (Very Hard, Very Slow drilling)				SS					N=50/1
2B2	ST-1	1.0-3.0	Brown FAT CLAY				CH					PP=3.25
2B2	ST-2	3.0-5.0	Brown, spotted reddish brown and dark brown LEAN CLAY	24.2	99.8	49 21 28	CL		FRACTURE			PP=2.5
2B2	SS-3	8.5-10.0	Reddish brown, spotted gray and dark brown FAT CLAY				CH					N=7
2B2	SS-4	13.5-15.0	Light reddish brown LEAN CLAY (weathered shale)(Very Hard, Very Slow drilling)				CL					N=71/11
2B3	ST-1	1.0-3.0	Brown FAT CLAY				CH					PP=3.25

Summary of Laboratory Testing

SLT 22205

Alpha-Omega Geotech, Inc.

1701 State Avenue
Kansas City, KS 66102
Office: (913) 371-0000 Fax: (913) 371-6710
Website: www.aogeotech.com



PROJECT NAME: FIRE STATION #5 - SITE #2
PROJECT LOCATION: LEE'S SUMMIT, MO

PROJECT NUMBER: 21-126E-2
DATE: 8/10/2021

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL PL PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression (psf)	%e	% Swell	Remarks
2B3	ST-2	3.0-5.0	Brown, mottled olive brown, spotted reddish brown FAT CLAY	25.8	97.5	60 22 38	CH		6788	5.2		PP=3.75
2B3	SS-3	8.5-10.0	Reddish brown, mottled light gray FAT CLAY				CH					N=6
2B3	SS-4	13.5-14.1	Brown, spotted reddish brown LEAN / FAT CLAY (weathered LIMESTONE)(Very Hard, Very Slow drilling)				CL-CH					N=50/1
2B4	ST-1	1.0-3.0	Brown LEAN / FAT CLAY				CL-CH					PP=2.75
2B4	ST-2	3.0-5.0	Brown, mottled gray, spotted dark brown FAT CLAY	23.9	97.1	57 22 35	CH		FRACTURE			PP=4.0
2B4	SS-3	8.5-10.0	Grayish brown, spotted reddish brown LEAN / FAT CLAY									N=7
2B4	SS-4	13.5-15.0	Brown, spotted reddish brown LEAN CLAY									N=5
2B4	SS-5	18.5-20.0	Brown, spotted reddish brown FAT CLAY with LIMESTONE fragments				CH					N=6
2B5	ST-1	1.0-3.0	Brown FAT CLAY				CH					PP=3.25

Summary of Laboratory Testing

SLT 22205

Alpha-Omega Geotech, Inc.

1701 State Avenue
Kansas City, KS 66102
Office: (913) 371-0000 Fax: (913) 371-6710
Website: www.aogeotech.com



PROJECT NAME:

FIRE STATION #5 - SITE #2

PROJECT NUMBER:

21-126E-2

PROJECT LOCATION:

LEE'S SUMMIT, MO

DATE:

8/10/2021

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits LL PL PI	USCS/ Visual Class.	% Passing No. 200	Unconfined Compression (psf)	%e	% Swell	Remarks
2B5	ST-2	3.0-5.0	Brown, spotted reddish brown and dark brown LEAN CLAY	25.8	98.5	47 21 26	CL		4022	6.3		PP=2.5
2B5	SS-3	8.5-10.0	Brown, mottled gray and reddish brown FAT CLAY				CH					N=8
2B5	SS-4	13.5-15.0	Brown mottled reddish brown FAT CLAY				CH					N=19
2B5	SS-5	18.5-18.6	Weathered Limestone (Very Hard, Very Slow drilling)				LS					N=50/1
2B6	SS-1	1.0-2.5	Brown LEAN / FAT CLAY				CL-CH					N=5
2B6	SS-2	3.5-5.0	Brown, spotted reddish brown and dark brown FAT CLAY				CH					N=7
2B6	SS-3	8.5-10.0	Brown, spotted reddish FAT CLAY				CH					N=7
2B7	SS-1	1.0-2.5	Brown FAT CLAY				CH					N=9
2B7	SS-2	3.5-5.0	Brown, mottled grayish brown, spotted reddish brown LEAN / FAT CLAY				CL-CH					N=7

Summary of Laboratory Testing

SLT 22205

Alpha-Omega Geotech, Inc.

1701 State Avenue
Kansas City, KS 66102
Office: (913) 371-0000 Fax: (913) 371-6710
Website: www.aogeotech.com

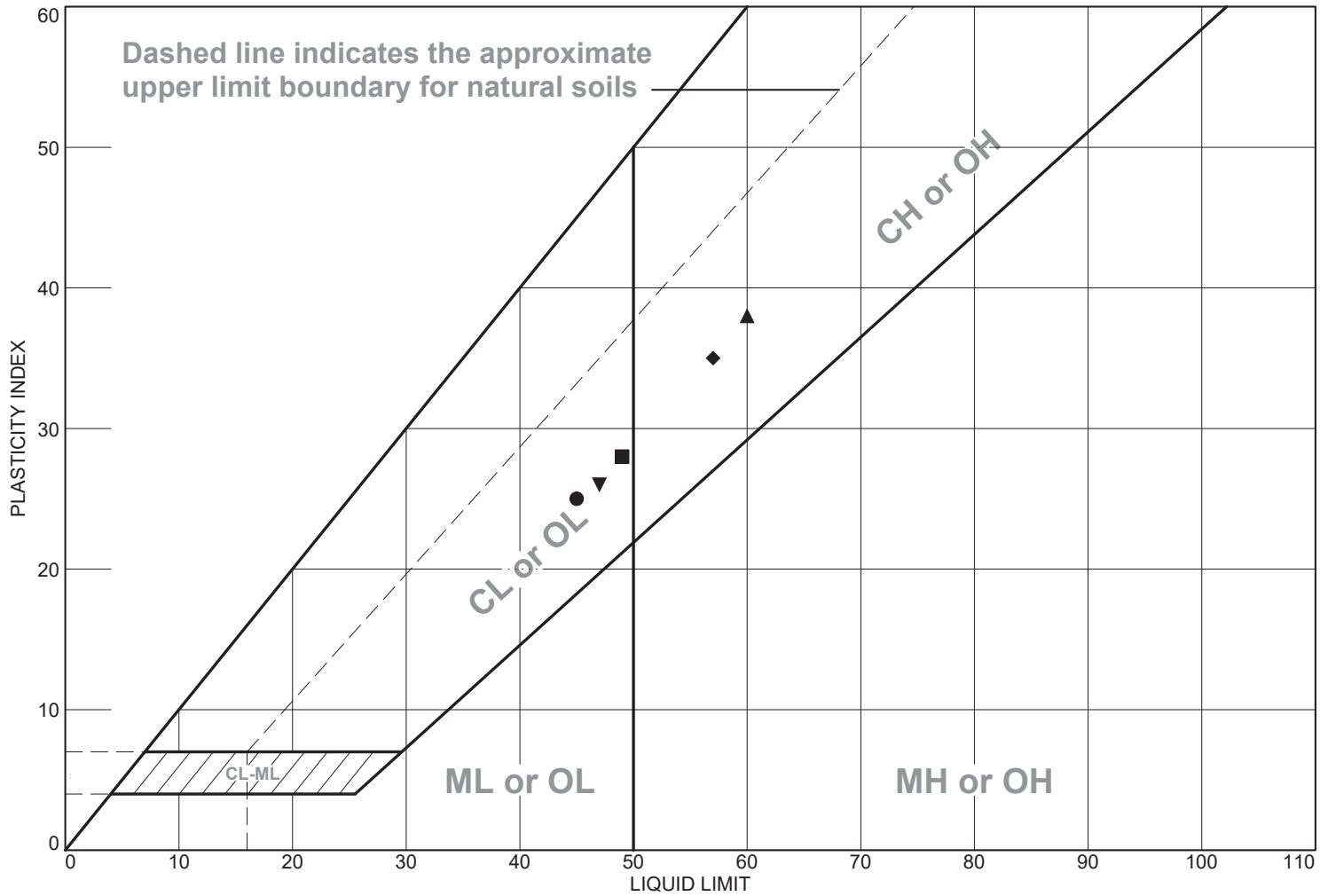


PROJECT NAME: FIRE STATION #5 - SITE #2
PROJECT LOCATION: LEE'S SUMMIT, MO

PROJECT NUMBER: 21-126E-2
DATE: 8/10/2021

Boring Number	Sample Number	Depth or Elevation	Description	Natural Moisture (%)	Dry Unit Weight (pcf)	Atterberg Limits			USCS/ Visual Class.	% Passing No. 200	Unconfined Compression (psf)	%e	% Swell	Remarks
						LL	PL	PI						
2B7	SS-3	8.5-10.0	Brown, spotted reddish brown and dark brown FAT CLAY						CH					N=8
2B8	SS-1	1.0-2.5	Brown FAT CLAY						CH					N=15
2B8	SS-2	3.5-5.0	Brown, spotted reddish brown LEAN / FAT CLAY						CH					N=6
2B8	SS-3	8.5-10.0	Reddish brown, spotted olive brown FAT CLAY						CH					N=7
2B9	SS-1	1.0-2.5	Brown, speckled reddish brown FAT CLAY						CH					N=9
2B9	SS-2	3.5-5.0	Brown, mottled reddish brown LEAN / FAT CLAY						CL-CH					N=9
2B9	SS-3	8.5-10.0	Olive brown, speckled dark brown FAT CLAY						CH					N=7

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown, speckled dark brown LEAN CLAY	45	20	25			CL
■	Brown, spotted reddish brown and dark brown LEAN CLAY	49	21	28			CL
▲	Brown, mottled olive brown, spotted reddish brown FAT CLAY	60	22	38			CH
◆	Brown, mottled gray, spotted dark brown FAT CLAY	57	22	35			CH
▼	Brown, spotted reddish brown and dark brown LEAN CLAY	47	21	26			CL

Project No. 21-126E Client: GLMV

Project: LEE'S SUMMIT FIRE STATION

● Source of Sample: 2B1 Depth: 3.0 Sample Number: ST-2
 ■ Source of Sample: 2B2 Depth: 3.0 Sample Number: ST-2
 ▲ Source of Sample: 2B3 Depth: 3.0 Sample Number: ST-2
 ◆ Source of Sample: 2B4 Depth: 3.0 Sample Number: ST-2
 ▼ Source of Sample: 2B5 Depth: 3.0 Sample Number: ST-2

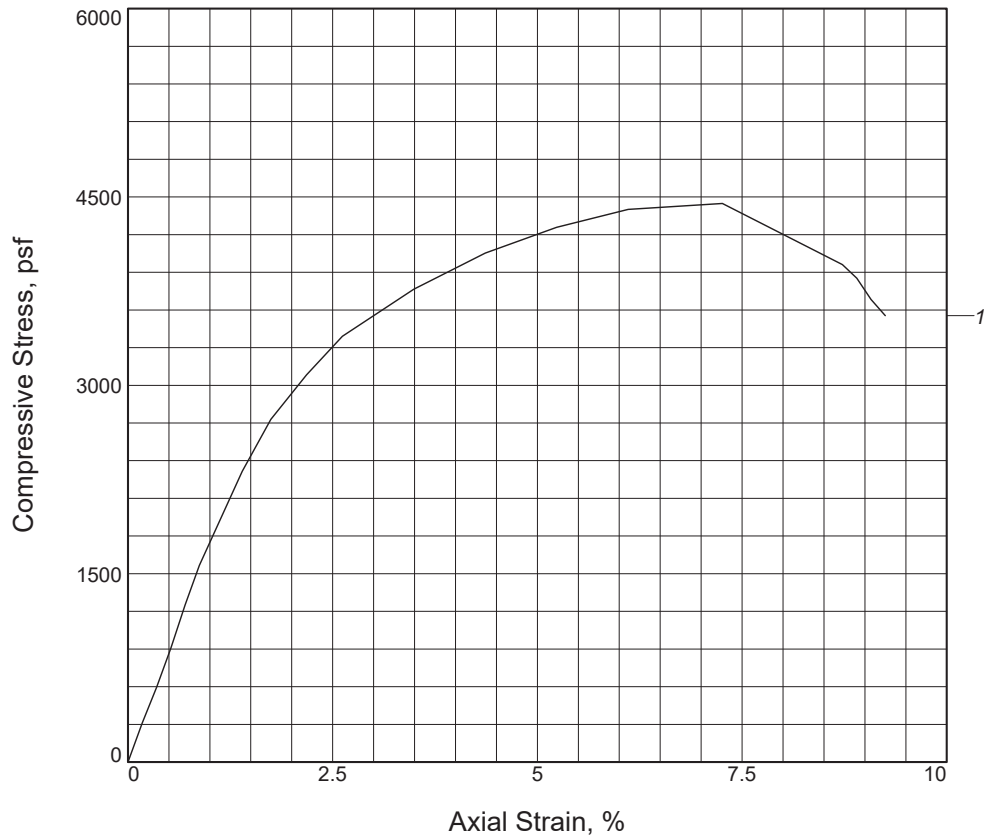


Remarks:

Figure

Tested By: D.B. Checked By: T.B.


UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	4449		
Undrained shear strength, psf	2224		
Failure strain, %	7.3		
Strain rate, in./min.	0.080		
Water content, %	23.2		
Wet density, pcf	124.2		
Dry density, pcf	100.8		
Saturation, %	93.2		
Void ratio	0.6722		
Specimen diameter, in.	2.870		
Specimen height, in.	5.730		
Height/diameter ratio	2.00		

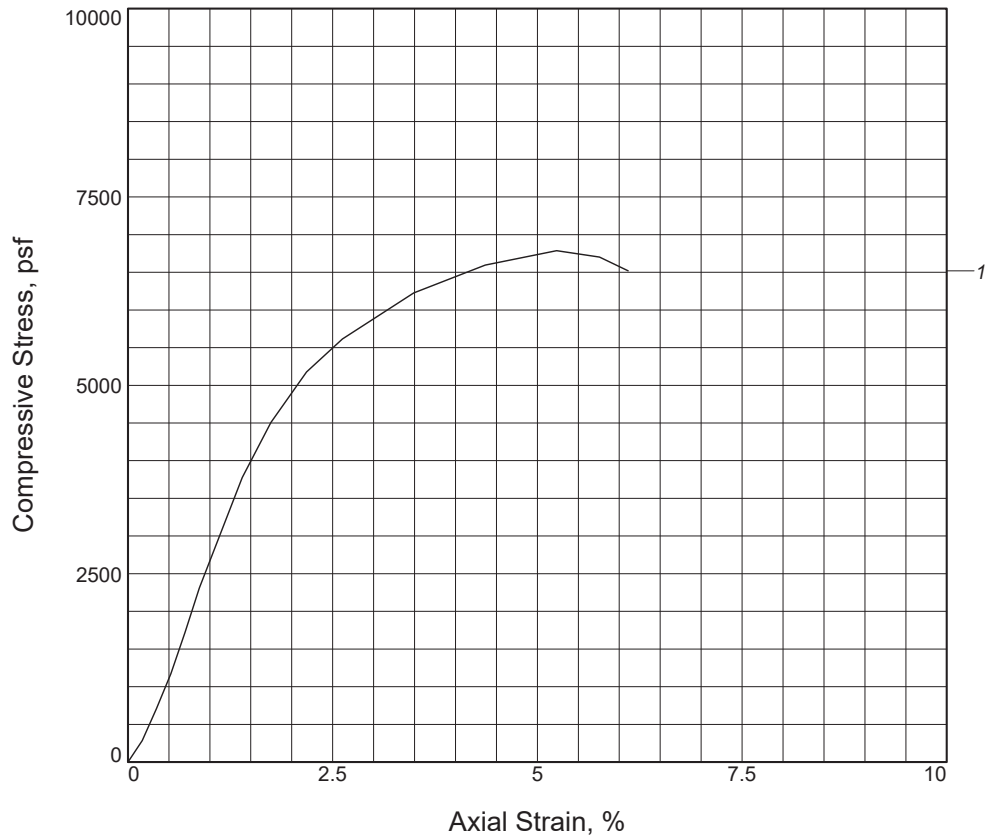
Description: Brown, speckled dark brown LEAN CLAY

LL = 45	PL = 20	PI = 25	Assumed GS= 2.70	Type: Undisturbed
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Project No.: 21-126E Date Sampled: 7/28/2021 Remarks:	Client: GLMV Project: LEE'S SUMMIT FIRE STATION Source of Sample: 2B1 Depth: 3.0 Sample Number: ST-2
Figure 1 of 1	

Tested By: D.B. Checked By: T.B.


UNCONFINED COMPRESSION TEST



Sample No.	1		
Unconfined strength, psf	6788		
Undrained shear strength, psf	3394		
Failure strain, %	5.2		
Strain rate, in./min.	0.080		
Water content, %	25.8		
Wet density, pcf	122.7		
Dry density, pcf	97.5		
Saturation, %	95.6		
Void ratio	0.7289		
Specimen diameter, in.	2.870		
Specimen height, in.	5.730		
Height/diameter ratio	2.00		

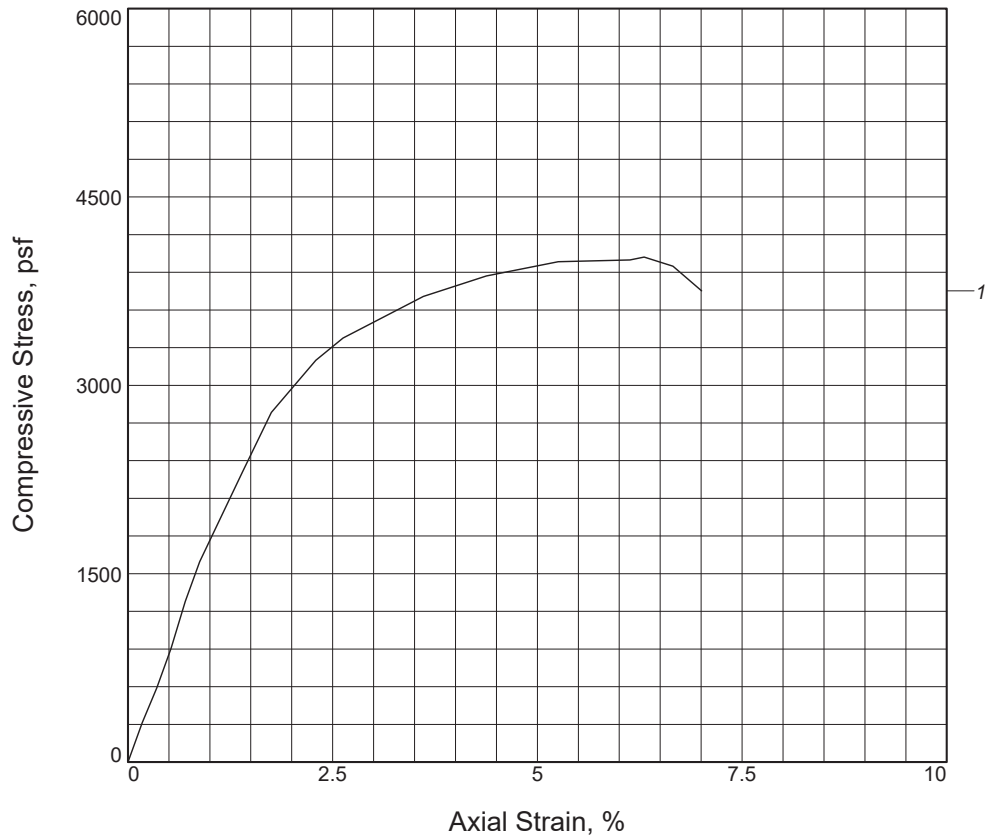
Description: **Brown, mottled olive brown, spotted reddish brown FAT CLAY**

LL = 60	PL = 22	PI = 38	Assumed GS= 2.7	Type: Undisturbed
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Project No.: 21-126E Date Sampled: 7/28/2021 Remarks:	Client: GLMV Project: LEE'S SUMMIT FIRE STATION Source of Sample: 2B3 Depth: 3.0 Sample Number: ST-2
Figure 1 of 1	

Tested By: D.B. Checked By: T.B.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psf	4022			
Undrained shear strength, psf	2011			
Failure strain, %	6.3			
Strain rate, in./min.	0.080			
Water content, %	25.8			
Wet density, pcf	123.9			
Dry density, pcf	98.5			
Saturation, %	97.8			
Void ratio	0.7114			
Specimen diameter, in.	2.860			
Specimen height, in.	5.710			
Height/diameter ratio	2.00			

Description: Brown, spotted reddish brown and dr brown LEAN CLAY

LL = 47	PL = 21	PI = 26	Assumed GS= 2.70	Type: Undisturbed
---------	---------	---------	------------------	-------------------

Project No.: 21-126E	Client: GLMV
Date Sampled: 7/28/2021	Project: LEE'S SUMMIT FIRE STATION
Remarks:	Source of Sample: 2B5 Depth: 3.0
	Sample Number: ST-2
Figure 1 of 1	

Tested By: D.B. Checked By: T.B.

Appendix Section C

BORING LOGS

Note: The logs of subsurface conditions shown in this section apply only at the specific boring location and depths at the date indicated and might not be indicative of all subsurface conditions that may be encountered. This information is not warranted to be representative of subsurface conditions at other locations, depths and times. The passage of time or construction operations at or adjacent to this site may result in changes to the soil conditions at these boring locations and depths. As a result, the character of subsurface materials shall be each bidder's responsibility.



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: ☒ NONE AFTER OURS: ☒ CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown FAT CLAY 4 root one								CH
		Brown FAT CLAY							4.00	CH
		Brown, spe led d r brown LEAN CLAY	23.2	100.8	45	25		4449	2.75	CL
5		Brown, spe led d r brown LEAN CLAY								CL
		Brown, spotted reddish brown nd d r brown FAT CLAY								CH
10		Brown, spotted reddish brown nd d r brown FAT CLAY								CH
		S ndstone Ver rd, Ver Slow drillin								Ss
15		No re over - S ndstone Ver rd, Ver Slow drillin								Ss
		Au er refus l on ro t bout 13.8 feet. End of Borin t bout 13.8 feet.								
20										
25										
30										
35										



LOG OF BORING
No. B

PROJECT: LEE'S SUMMIT FIRE STATION PROJECT NO.: 21-126E
 CLIENT: GLMV
 PROJECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELEVATION: N
 DRILLER: . MARTIN LOGGED BY: M. GASTON
 DRILLING METHOD: AO DATE: 7-21-21
 DEPT TO WATER INITIAL: NONE AFTER HOURS: NONE CAUSING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown FAT CLAY 3 root one								CH
		Brown FAT CLAY							3.25	CH
		Brown, spotted reddish brown and dr brown LEAN CLAY	24.2	99.8	49	28		N/D	2.5	CL
5		Brown, spotted reddish brown and dr brown LEAN CLAY								CL
		Reddish brown, spotted r and dr brown FAT CLAY								CH
10		Reddish brown, spotted r and dr brown FAT CLAY								CH
		Light reddish brown LEAN CLAY we thered sh le Ver rd, Ver Slow drillin								CL
15		Light reddish brown LEAN CLAY we thered sh le Ver rd, Ver Slow drillin								CL
		Light reddish brown LEAN CLAY we thered sh le Ver rd, Ver Slow drillin								CL
		ethered Limestone Ver rd, Ver Slow drillin								Ls
20		Au er refus l on ro t bout 16.0 feet. End of Borin t bout 16.0 feet.								
25										
30										
35										



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: ☒ NONE AFTER OURS: ☒ CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown FAT CLAY 3 root one								CH
		Brown FAT CLAY							3.25	CH
		Brown, mottled olive brown, spotted reddish brown FAT CLAY	25.8	97.5	60	38		6788	3.75	CH
5		Brown, mottled olive brown, spotted reddish brown FAT CLAY								CH
		Reddish brown, mottled li ht r FAT CLAY								CH
10		Reddish brown, mottled li ht r FAT CLAY								CH
		ethered LIMESTONE Ver rd, Ver Slow drillin								Ls
15		Brown, spotted reddish brown LEAN / FAT CLAY we thered LIMESTONE Ver rd, Ver Slow drillin								CL-CH Ls
		ethered Limestone Ver rd, Ver Slow drillin								
20		Au er refus l on ro t bout 14.9 feet. End of Borin t bout 14.9 feet.								
25										
30										
35										



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: 18.3' AFTER OURS: CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown LEAN / FAT CLAY 3 root one								CL-CH
		Brown LEAN / FAT CLAY							2.75	CL-CH
										CH
		Brown, mottled r , spotted d r brown FAT CLAY	23.9	97.1	57	35		N/D	4.0	CH
5		Brown, mottled r , spotted d r brown FAT CLAY								CH
		Gr ish brown, spotted reddish brown LEAN / FAT CLAY								CL-CH
10		Gr ish brown, spotted reddish brown LEAN / FAT CLAY								CL-CH
		Brown, spotted reddish brown LEAN CLAY								CL
15		Brown, spotted reddish brown LEAN CLAY								CL
		Brown, spotted reddish brown FAT CLAY with LIMESTONE fr ments								CH
20		End of Borin t bout 20.0 feet.								
25										
30										
35										



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: 18.0' AFTER OURS: CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown FAT CLAY 3 root one								CH
		Brown FAT CLAY							3.25	CH
		Brown, spotted reddish brown nd d r brown LEAN CLAY								CL
5		Brown, spotted reddish brown nd d r brown LEAN CLAY								CL
		Brown, mottled r nd reddish brown FAT CLAY								CH
10		Brown, mottled r nd reddish brown FAT CLAY								CH
		Brown mottled reddish brown FAT CLAY								CH
15		Brown mottled reddish brown FAT CLAY								CH
		ethered Limestone Ver rd, Ver Slow drillin								Ls
20		ethered Limestone Ver rd, Ver Slow drillin								Ls
		Au er refus l on ro t bout 18.6 feet. End of Borin t bout 18.6 feet.								
25										
30										
35										



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: ☒ NONE AFTER OURS: ☒ CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown LEAN / FAT CLAY 4 root one								CL-CH
1.0		Brown LEAN / FAT CLAY								CL-CH
2.5		Brown LEAN / FAT CLAY								CL-CH
3.5		Brown, spotted reddish brown nd d r brown FAT CLAY								CH
5.0		Brown, spotted reddish brown nd d r brown FAT CLAY								CH
8.5		Brown, spotted reddish FAT CLAY								CH
10.0		End of Borin t bout 10.0 feet.								
15										
20										
25										
30										
35										



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: ☒ NONE AFTER OURS: ☒ CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown FAT CLAY 5 root one								CH
1.0		Brown FAT CLAY								CH
2.5		Brown FAT CLAY								CH
3.5		Brown, mottled r ish brown, spotted reddish brown LEAN / FAT CLAY								CL-CH
5.0		Brown, mottled r ish brown, spotted reddish brown LEAN / FAT CLAY								CL-CH
8.5		Brown, spotted reddish brown nd d r brown FAT CLAY								CH
10.0		End of Borin t bout 10.0 feet.								
15										
20										
25										
30										
35										



LOG OF BORING
No. B







PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: ☒ NONE AFTER OURS: ☒ CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown FAT CLAY 3 root one								CH
6.6 6.9		Brown FAT CLAY	1.0							CH
2.5		Brown FAT CLAY								CH
3.3 3.3		Brown, spotted reddish brown LEAN / FAT CLAY	3.5							CL-CH
5		Brown, spotted reddish brown LEAN / FAT CLAY	5.0							CL-CH
8.5		Reddish brown, spotted olive brown FAT CLAY	8.5							CH
10		End of Borin t bout 10.0 feet.	10.0							
15										
20										
25										
30										
35										



LOG OF BORING
No. B

PRO ECT: LEE'S SUMMIT FIRE STATION PRO ECT NO.: 21-126E
 CLIENT: GLMV
 PRO ECT LOCATION: LEE'S SUMMIT, MO
 LOCATION: SEE SITE S ETC ELE ATION: N
 DRILLER: . MARTIN LOGGED B : M. GASTON
 DRILLING MET OD: AO DATE: 7-21-21
 DEPT TO ATER INITIAL: ☒ NONE AFTER OURS: ☒ CA ING C. NONE

Elevation	Soil Symbols Sampler Symbols and Field Test Data	Description	w%	DDen pcf	LL	PI	200 %	Uncomp. psf	PPen. tsf	USCS/ Visual Class.
Depth (ft.)										
0		Brown, spe led reddish brown FAT CLAY 3 root one								CH
4.4 4.5		Brown, spe led reddish brown FAT CLAY								CH
2.5 3.5		Brown, spe led reddish brown FAT CLAY								CH
4.4 4.5		Brown, mottled reddish brown LEAN / FAT CLAY								CL- CH
5.0		Brown, mottled reddish brown LEAN / FAT CLAY								CL- CH
8.5		Olive brown, spe led d r brown FAT CLAY								CH
10.0		End of Borin t bout 10.0 feet.								
10										
15										
20										
25										
30										
35										

E T O S MBOLS

Symbol Description

Symbol Description

Strata symbols



FAT CLAY



LEAN CLAY



SANDSTONE



Weathered LIMESTONE



FAT / LEAN CLAY w/ Limestone fragments



FAT/LEAN CLAY



FAT CLAY w/ Limestone fragments

Misc. Symbols



Drill rejection



Water table during drilling

Soil Samplers



Undisturbed thin wall Shelby tube



Standard penetration test

Notes:

1. Borings were drilled on July 21-22, 2021 using solid stem auger, split spoon sampler and shelby tube sampler techniques.
 2. Ground water was not encountered while drilling at the reported depths.
 3. Borings were staked by Alpha-Omega, Inc.
 4. These logs are subject to the limitations, conclusions, and recommendations in this report.
 5. Results of tests conducted on samples recovered are reported on the logs.
- Abbreviations are:

DDen =	natural dry density (pcf)	LL =	Liquid
limit			
w% =	natural moisture content (%)	PI =	Plasticity
index			
UComp =	Unconfined compression (psf)	PPen =	Pocket
Penetrometer			
-200 =	percent passing #200 sieve (%)	RQD =	Rock
Quality			
DCP =	Dynamic Cone Penetrometer		

SECTION 011000 - 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. Owner-furnished/Contractor-installed (OFICI) products.
4. Owner-furnished/Owner-installed (OFOI) products.
5. Contractor-furnished/Owner-installed (CFOI) products.
6. Contractor's use of site and premises.
7. Coordination with occupants.
8. Work restrictions.
9. Specification and Drawing conventions.
10. Miscellaneous provisions.

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

1.3 DEFINITIONS

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

1.4 PROJECT INFORMATION

- A. Project Identification: Fire Station #5.

1. Project Location: 801 Missouri Highway 150, Lee's Summit, MO 64082.

- B. Owner: City of Lee's Summit, Missouri.

1. Owner's Representative: Assistant Fire Chief, Kevin McCaw.
Phone: 816-969-1302.
Email: kevin.mccaw@cityofls.net.

2. Owner's Representative: Deputy Fire Chief, Brian Austerman.
Phone: 816-969-1320
Email: brian.austerman@cityofls.net.
- C. Architect: GLMV Architecture, Inc.
 1. Architect's Representative: Paul J. Michell, AIA, Vice President.
Phone: 816-652-0624.
Email: paul.michell@glmv.com.
- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
 1. GLMV Architecture, Inc.
 - a. Civil Engineer: Derick Holmes, PE.
Phone: 816-444-4200.
Email: derick.holmes@glmv.com.
 - b. Landscape Architect: Kyle Ward, PLA, ASLA, LEED AP BD+C.
Phone: 816-444-4200.
Email: kyle.ward@glmv.com.
 2. Hoss & Brown Engineers, Inc.
 - a. Mechanical, Electrical, and Plumbing Engineer: Jim Lord, PE.
Phone: 913-802-8206.
Email: jlord@h-be.com.
 3. Henderson Engineers, Inc.
 - a. Technology/Audio-Visual/Security: Mark Maurer.
Phone: 913-742-5622.
Email: mark.maurer@hendersonengineers.com.
 4. FGM Architects
 - a. Architecture and Interiors: Robert Celio, AIA, LEED AP.
Phone: 703-956-5628.
Email: robertcelio@fgmarchitects.com.
 5. Leigh & O'Kane, LLC
 - a. Structural Engineer: Jordan Bennett.
Phone: 816-444-3144.
Email: jbennett@leok.com.

- E. Construction Manager: McCownGordon Construction.
 - 1. Construction Manager Representative: Chloe Huxol.
Phone: 816-547-0068.
Email: chuxol@mccowngordon.com.
 - 2. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.
- F. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 013100 "Project Management and Coordination" for requirements for using web-based Project software.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
 - 1. The known scope of the Project is for a new 2-story, 3-bay fire station of approximately 10,000 to 12,000 gross square feet. Twenty-four-hour living facilities for 8 personnel. Office facilities for 1 company officer and 1 common/shared office space. Housing for 1 fire apparatus, 1 ambulance, and support apparatus (anticipated design for up to 3 bays approximately 70 to 75 feet deep). Classroom for training. Wellness facility/area. Exterior storage facility, covered trash enclosure, and other requirements to meet local building standards. Diesel exhaust filtration system. Affordable, LEED-based principles (not seeking LEED certification). Decontamination areas. Security/access control and special systems compatible with existing facilities. Integral workspace, and other Work indicated in the Contract Documents.
- B. Type of Contract: Project will be constructed under a single prime contract.

1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 - 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 - 2. Provide for delivery of Owner-furnished products to Project site.
 - 3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 - 4. Obtain manufacturer's inspections, service, and warranties.
 - 5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Bronze plaque
2. 66-inch Smart TV
3. Personal protective equipment (PPE) washing machine
4. PPE dryer
5. Dishwasher
6. Washing machine
7. Dryer

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products:

1. Gas grill
2. UPS
3. Captain's markerboard
4. PPE gear lockers
5. Kitchen refrigerator/freezer
6. Coffee makers
7. Microwaves
8. Dayroom TVs and brackets
9. Apparatus Bay hose racks
10. Apparatus Bay TV
11. Exercise Room TV and bracket
12. Bunk coat hook
13. Bunk TV and bracket

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

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

1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. 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 scheduled on Drawings and published as part of the U.S. National CAD Standard.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012300 - ALTERNATES

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 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 the 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. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise 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. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article 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.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate 1:

1. Base Bid: Three 4-fold doors per Station and 3 sectional doors per Station.
2. Alternate: Remove Base Bid doors and construction specific to those items. Provide and install 3 high-speed coiling doors per Station and 3 sectional doors per Station. Provide and install all associated mounting, reinforcing, power, and controls necessary for a complete, functional installation.

B. Alternate 2:

1. Base Bid: Three 4-fold doors per Station and 3 sectional doors per Station.
2. Alternate: Remove Base Bid doors and construction specific to those items. Provide and install 3 high-speed coiling doors per Station and 3 average-speed coiling doors per Station. Provide and install all associated mounting, reinforcing, power, and controls necessary for a complete, functional installation.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific

- features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.

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Lee's Summit, Missouri

- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 013100 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Web-based Project management software package.
 - 6. Project meetings.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in sequence required to obtain the best results, where installation of 1 part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. 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 and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than 1 entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Submittal Format: Submit or post coordination drawing files using PDF format.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Owner name.
 3. Owner's Project number.
 4. Name of Architect.
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.
 1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 7 days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number, including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.

8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Architect's Data Files Not Available: Architect will not provide Architect's BIM model or CAD drawing digital data files for Contractor's use during construction.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
 1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: Construction Manager 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. Notify Owner and Architect of scheduled meeting dates and times a minimum of 7 days prior to meeting.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within 3 days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.

- b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.
 - aa. Security.
 - bb. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager, and Owner's Commissioning Authority of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.

- g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Construction Manager will schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.

- f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Construction Manager will conduct progress meetings at biweekly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. 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.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.

- 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 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 for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.

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 Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in PDF file format.
- B. Startup construction schedule.
 - 1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at monthly intervals.
- F. Material Location Reports: Submit at monthly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.
- H. Unusual Event Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing, work stages, area separations, and interim milestones.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 COORDINATION

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

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Time Frame: Extend schedule from date established for commencement of the Work to date of Final 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.
- B. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Interfaces with Separate Contracts.
 - f. Regulatory agency approvals.
 - g. Punch list.
 3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 6. Commissioning Time: Include no fewer than 15 days for commissioning.
 7. 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.
 8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 1. Phasing: Arrange list of activities on schedule by phase.
 2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 4. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.

- e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
- a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing
 - l. Commissioning.
6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
- 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and the Contract Time.
- F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule 1 week before 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. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate Final Completion percentage for each activity.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within 7 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 for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.
1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.10 CPM SCHEDULE REQUIREMENTS

- A. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- B. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- C. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.
- D. Value Summaries: Prepare 2 cumulative value lists, sorted by finish dates.
 - 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 - 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 - 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 - 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts 1 week before each regularly scheduled progress meeting.

1.11 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Testing and inspection.
 8. Accidents.
 9. Meetings and significant decisions.
 10. Unusual events.
 11. Stoppages, delays, shortages, and losses.
 12. Meter readings and similar recordings.
 13. Emergency procedures.
 14. Orders and requests of authorities having jurisdiction.
 15. Change Orders received and implemented.
 16. Construction Change Directives received and implemented.
 17. Services connected and disconnected.
 18. Equipment or system tests and startups.
 19. Partial completions and occupancies.
 20. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: 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, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Submit unusual event reports directly to Owner within 1 day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233 - 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. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
 - 4. Final Completion construction photographs.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within 3 days of taking photographs.
 - 1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in web-based Project management software site:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3,200 by 2,400 pixels. Use flash in low light levels or backlit conditions.

- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date and Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- D. Periodic Construction Photographs: Take 20 photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents.
- F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified.
 - 1. 3 days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs are to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

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

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.

- b. Specification Section number and title.
- c. Submittal Category: Action; informational.
- d. Name of subcontractor.
- e. Description of the Work covered.
- f. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

- 1. Project name.
- 2. Date.
- 3. Name of Architect.
- 4. Name of Construction Manager.
- 5. Name of Contractor.
- 6. Name of firm or entity that prepared submittal.
- 7. Names of subcontractor, manufacturer, and supplier.
- 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
- 9. Category and type of submittal.
- 10. Submittal purpose and description.
- 11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
- 12. Drawing number and detail references, as appropriate.
- 13. Indication of full or partial submittal.
- 14. Location(s) where product is to be installed, as appropriate.
- 15. Other necessary identification.
- 16. Remarks.
- 17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

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

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

E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain 1 copy of file as a digital Project Record Document file.
 - 2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, 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 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.
 - 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

- D. 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 with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

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

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - a. 3 opaque copies of each submittal. Architect will retain 2 copies; remainder will be returned.
- C. Samples: Submit samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit samples that contain multiple, related components, such as accessories together in 1 submittal package.
 2. Identification: Permanently attach label on unexposed side of samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating sample characteristics and identification information for record.
 4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. Paper Transmittal: Include paper transmittal, including complete submittal information indicated.
 6. 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.

7. 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 1 full set 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.
8. 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 3 sets of samples. Architect will retain 2 sample sets; remainder will be returned. Mark up and retain 1 returned sample set as a project record sample.
 - 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 3 sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

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

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

1.7 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and 3 paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

- A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action.
 - 2. Submittals by Web-Based Project Management Software: Architect and Construction Manager will indicate, on Project management software website, the appropriate action.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect and Construction Manager will return without review submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 014000 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Requirements: Section 012100 "Allowances" for testing and inspection allowances.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of 5 previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 1. Mockups are used for 1 or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- H. 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.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

1.4 DELEGATED DESIGN SERVICES

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

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

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with 2 or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 ACTION SUBMITTALS

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

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than 5 days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and

- inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
- 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
- 1. Name, address, telephone number, and email address of technical 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 of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in

individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 - 3. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow 7 days for initial review and each re-review of each mockup.
 - 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 - 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 10. Demolish and remove mockups when directed unless otherwise indicated.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspection allowances as authorized by Change Orders.

3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. 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.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including

service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. 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 inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
 - 1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 - 2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 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, as indicated in the Statement of Special Inspections attached to this Section, and as follows:
1. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, with copy to Contractor and to authorities having jurisdiction.
 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 5. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's and authorities' having jurisdiction reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

CITY OF LEE'S SUMMIT, MISSOURI – FIRE STATION #5

STATEMENT OF SPECIAL INSPECTION

In accordance with Section 1704 of the International Building Code (IBC), the owner, or the registered design professional in responsible charge acting as the owner's agent, is required to hire an independent testing/inspection agency to perform required special inspections.

Project information:

- Risk category: **IV**
- Seismic design category: **B**
- Wind exposure: **C**
- Storm shelter wind exposure: **B**

A. Owner Responsibilities

1. The owner shall fund special inspection services. The owner is responsible for seeing that these requirements are met.

B. Registered Design Professional Responsibilities

1. The registered design professional in responsible charge (engineer, or architect), shall include special inspection requirements and specifications on the plans.
2. Provide structural observation Per IBC Section 1704.6 requirements and specifications on the plans.
3. Prepare the Statement of Special Inspections in accordance with IBC section 1704.2.3 and identify Structural Testing for Seismic Resistance per IBC section 1708 (when required). The statement of special inspections shall identify items fabricated on the premises of an approved fabricator where special inspections are not required by section 1704.2.1.
4. Review the special inspection reports and provide corrective action for work that may not conform to the approved plans.

C. Contractor's Responsibilities

1. Notify the agency. The contractor is responsible for notifying the inspection agency in sufficient time for scheduling personnel to perform required inspections.
2. Written statement of responsibility.
3. Provide access to city approved plans. The approved plans shall be readily accessible at the job site.
4. Provide access to work. The contractor shall provide reasonable access to all work requiring special inspection.
5. Retaining special inspection reports at the job site. The contractor is also responsible for retaining at the job site all special inspection records submitted by the special inspector, and providing these records for review by the Building Division's inspector upon request.
6. Notify Building Division of special inspections prior to scheduled inspection time.

7. Provide a copy of special inspector's credentials when requested by the jurisdiction.

D. Duties of the Special Inspector

1. Provide city permitting office with engagement letter and scope of work. The inspecting agency shall immediately upon hire furnish the permitting office with a detailed scope of work indicating what inspections and tests shall be conducted and whether they will be periodic or continuous.
2. Observe the work. The inspector shall observe the work for compliance with the jurisdiction approved plans, specifications, and applicable provisions of the IBC. The architect/engineer's reviewed shop drawings, and/or placement drawings, may be used only as an aid to inspections.
 - *Continuous Special Inspection* – The full-time observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed.
 - *Periodic Special Inspection* – The part-time or intermittent observation of work requiring special inspection by an approved special inspector who is present in the area where the work is being performed and at the completion of the work.
3. Report non-conforming items. The inspector shall bring non-conforming items to the immediate attention of the contractor and note all such items in the daily report. If any item is not resolved in a timely manner and is about to be incorporated in the work, the special inspector shall immediately notify the engineer or architect of record. Where an appropriate action is not taken by either the contractor or the engineer or architect of record to correct the non-conforming item(s), the special inspector shall immediately notify the Building Division.
4. Furnish daily reports. The special inspector shall complete a daily report for each day's inspections. The daily reports shall remain at the job site with the contractor for the Building Division's inspector. The reports shall include the following:
 - Name of special inspector.
 - Description of the inspections, with locations and tests performed.
 - Listing any non-conforming items.
 - Include how items were resolved or unresolved.
 - List any changes or corrections to non-conforming issues authorized by the engineer, architect, or Building Division's inspectors.
5. Furnish weekly reports. The inspection agency shall furnish weekly reports of the tests and inspections performed directly to the Building Division, project engineer, architect, and/or others as designated.
6. Furnish final report. The inspection agency shall submit a final signed report to the Building Division stating that all items requiring special inspections and testing were fulfilled, all discrepancies were corrected or resolved, and all work requiring special inspections is in conformance with the approved design drawings and specifications. Any items unresolved or discrepancies in coverage (i.e., missed inspections, periodic inspections when continuous was required, etc.) shall be specifically itemized in this report.
7. Reference specifications. The inspection agency shall have access to the latest specifications and be familiar with the requirements set forth in the various sections. The agency shall notify the design professionals regarding any discrepancies between inspection or testing requirements between the drawings, specifications, governing code documents or testing standards.

E. Jurisdiction

The jurisdiction will review the implementation of Structural Tests and Special Inspection requirements.

1. Review special inspections. The Building Division shall review all special inspectors and special inspection requirements found in IBC Chapter 17.
2. Monitor special inspections. Work requiring special inspections, and the performance of special inspectors, may be monitored by the Building Division's inspector. The Building Division's approval must be obtained prior to placement of concrete or other similar activities in addition to that of the special inspector.
3. Issue Certificate of Occupancy. The Building Division will only issue a Certificate of Occupancy after all special inspection reports and the final special inspection report, have been submitted and accepted.

SPECIAL INSPECTIONS REQUIRED

A. Special inspections not listed in IBC Chapter 17

Per ICC-500 2020 §110, special inspections shall take place under the following conditions:

- Construction materials and systems that are alternatives to traditional materials and systems prescribed by the IBC.
- Unusual design and construction applications
- Anchors post-installed in hardened concrete and masonry, where used for anchorage of storm shelter components forming a part of the storm shelter enclosure or for the anchorage of the storm shelter structure to foundations shall be in accordance with ICC-500 section 110.1.2.1

B. Special inspections per 2018-IBC Chapter 17

Summary:

SECTION	TYPE AND EXTENT	APPLICABLE	NOTES
1705.1.1	Special cases	<input type="checkbox"/>	
1705.2	Steel construction	<input checked="" type="checkbox"/>	
1705.3	Concrete construction	<input checked="" type="checkbox"/>	
1705.4	Masonry construction	<input checked="" type="checkbox"/>	
1705.5	Wood construction	<input type="checkbox"/>	
1705.6	Soils	<input checked="" type="checkbox"/>	
1705.7	Driven deep foundations	<input type="checkbox"/>	
1705.8	Cast-in-place deep foundations	<input type="checkbox"/>	
1705.9	Helical pile foundations	<input type="checkbox"/>	
1705.10	Fabricated items	<input type="checkbox"/>	
1705.11	Special inspections for wind resistance	<input checked="" type="checkbox"/>	
1705.12	Special inspections for seismic resistance	<input type="checkbox"/>	
1705.13	Testing for seismic resistance	<input type="checkbox"/>	
1705.14	Sprayed fire-resistant materials	<input type="checkbox"/>	
1705.15	Mastic and intumescent fire-resistant coatings	<input type="checkbox"/>	Per AWCI 12-B
1705.16	Exterior insulation and finish system (EIFS)	<input checked="" type="checkbox"/>	§1705.6.1
1705.17	Fire-resistant penetrations and joints	<input checked="" type="checkbox"/>	ASTM E2174/ E2393
1705.18	Special inspection for smoke control	<input checked="" type="checkbox"/>	

§1705.2 – Steel Construction

TYPE	CONTINUOUS	PERIODIC	NOTES
Structural steel	<input type="checkbox"/>	<input type="checkbox"/>	
Cold-formed steel deck	<input type="checkbox"/>	<input type="checkbox"/>	
Open-web steel joists girders (installation)			
End connections – welding or bolted	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Bridging – horizontal or diagonal	<input type="checkbox"/>	<input type="checkbox"/>	
Standard bridging	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Bridging that differs from the SJI specifications	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

§1705.3 – Concrete construction

Exception: Special inspections and tests shall not be required for:

1. Isolated spread concrete footings of buildings three stories or less above grade plane that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above grade plane that are fully supported on earth or rock where:
 - a. The footings support walls of light-frame construction.
 - b. The footings are designed in accordance with Table 1809.7.
 - c. The structural design of the footing is based on a specified compressive strength, f'_{cr} not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the approved construction documents or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).
4. Concrete foundation walls constructed in accordance with IBC Table 1807.1.6.2.
5. Concrete patios, driveways, and sidewalks, on grade.

TYPE	CONTINUOUS	PERIODIC	NOTES
Welding of reinforcing bars	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Inspect reinforcement, including prestressing tendons and verify placement	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Reinforcing bar welding:			
Verify weldability of reinforcing bars other than ASTM A706	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Inspect single-pass fillet welds, maximum 5/16"	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Inspect all other welds	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Inspect anchors cast in concrete	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Inspect anchors post-installed in hardened concrete members:			
Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Other mechanical and adhesive anchors	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Verify use of required design mix	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Inspect concrete and shotcrete placement for proper application techniques	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Verify maintenance of specified curing temperature and techniques	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Inspect prestressed concrete for:			
Application of prestressing forces	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Grouting of bonded prestressing tendons	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Inspect erection of precast concrete members	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Inspect formwork for shape, location and dimensions of the concrete member being formed	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Material tests	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

§1705.4 – Masonry construction

TYPE	CONTINUOUS	PERIODIC	NOTES
Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with IBC section 2109 or chapter 14, where they are part of a structure classified as Risk Category IV	<input type="checkbox"/>	<input checked="" type="checkbox"/>	In accordance with TMS 602, Level 2
Vertical masonry foundation elements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

§1705.6 – Soils

TYPE	CONTINUOUS	PERIODIC	NOTES
Verify materials below shallow foundations are adequate to achieve the design bearing capacity	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Verify excavations are extended to proper depth and have reached proper material	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Perform classification and testing of compacted fill materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Verify use of proper materials, densities, and lift thickness during placement and compaction of compacted fill	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
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§1705.10 – Fabricated items

Special inspections on fabricated items shall be performed in accordance with IBC section 1704.2.5

§1705.11 Special inspections for wind resistance

TYPE	CONTINUOUS	PERIODIC	NOTES
Structural wood	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Cold-formed steel light-frame construction	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Wind-resisting components:			
Roof covering, roof deck and roof framing connections	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Exterior wall covering and wall connections to roof and floor diaphragms and framing	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

SECTION 015000 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements: Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. 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.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- F. 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. 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. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

2.2 TEMPORARY FACILITIES

- A. Field Offices: 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, 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 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 degrees F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc 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. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with 4-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

3.2 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.
1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- 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.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service.
- 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: Install water service and distribution piping in sizes and pressures adequate for construction.

- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash 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. Temporary 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.
 - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. 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 overhead unless otherwise indicated.
- G. 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.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install Wi-Fi cell phone access equipment and 1 land-based telephone line for each field office.
 - 1. 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. Construction Manager's home office.
 - g. Engineers' offices.
 - h. Owner's office.
 - i. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure Wi-Fi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect 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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
 - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with new sitework.
 - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
 - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."
- D. 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.
- E. Parking: Provide temporary offsite parking areas for construction personnel.
- F. Storage and Staging: Provide temporary offsite area or use designated areas of Project site for storage and staging needs.
- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

H. 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 touch up signs, so they are legible at all times.

I. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

J. 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.

K. Temporary Elevator Use: Use of elevators is not permitted.

L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

M. 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.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. 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.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. 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.

1. Comply with work restrictions specified in Section 011000 "Summary."

- C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- D. 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.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. 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 materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations or as indicated on Drawings.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish 1 set of keys to Owner.
- H. 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 workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. 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.
- K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
 - 1. Construct dustproof partitions with 2 layers of 6-mil polyethylene sheet on each side. Cover floor with 2 layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

- a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
2. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
3. Protect air-handling equipment.
- L. 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. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with 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.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: 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 Period: 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 and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

- D. Controlled Construction Period: 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 temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 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 and require replacing.
 - 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 and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 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.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

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 015000

SECTION 016000 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design

product also establish salient characteristics of products for purposes of evaluating comparable products.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between 2 or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Resolution of Compatibility Disputes between Multiple Contractors:
 - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.

2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

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 and vandalism. 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 determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 2. Store products to allow for inspection and measurement of quantity or counting of units.
 3. Store materials in a manner that will not endanger Project structure.
 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.

5. Protect 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.

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: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.

4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide 1 of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide 1 of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide 1 of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by 1 of the manufacturers listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

- a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by 1 of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by 1 of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution if the product complies with requirements.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by 1 of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by 1 of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, 2-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 PREINSTALLATION MEETINGS

- A. Layout Conference: Conduct conference at Project site.
 - 1. Prior to establishing layout of perimeter and structural grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
 - 2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
 - 3. Review requirements for including layouts on Shop Drawings and other submittals.
 - 4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Certified Surveys: Submit 2 copies signed by land surveyor or professional engineer.
- C. Certificates: Submit certificate signed by land surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Final Property Survey: If Project scope includes new buildings or additions to existing buildings that change the footprint and ground level, submit 10 copies showing the Work performed and record survey data.

1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from 2 or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

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

- B. Benchmarks: Establish and maintain a minimum of 2 permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in General Commissioning Requirements.
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.8 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 for the following:
 - 1. Recycling nonhazardous construction waste.
 - 2. Disposing of nonhazardous construction waste.

1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal of construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- C. Recycle: Recovery of construction waste for subsequent processing in preparation for reuse.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, construction waste becomes property of Contractor.

1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.6 INFORMATIONAL SUBMITTALS

- A. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

- B. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- C. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- D. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.
- B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Use Form CWM-1 for construction waste. Include estimated quantities and assumptions for estimates.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within 3 days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.4 DISPOSAL OF WASTE

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

END OF SECTION 017419

SECTION 017700 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

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

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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

1. 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.

1.8 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

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

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

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 1. Submit on digital media acceptable to Architect by uploading to web-based project software site or by email to Architect.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. 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.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

- k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

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

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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 for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect by email to Architect. Enable reviewer comments on draft submittals.

- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

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

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.

5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than 1 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 1 system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.

2. Emergency instructions.
 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.

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

C. Descriptions: Include the following:

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

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

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

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment 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 and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than 1 item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. 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.
- J. 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.

1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. 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 and drawing or schedule designation or identifier where applicable.
- D. 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.
- E. 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.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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 for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit 1 paper copy set of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints and 1 set of file prints.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit 1 paper copy set of marked-up record prints.
 - 2) Submit PDF electronic files of scanned Record Prints and 1 set of file prints.
 - 3) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain 1 set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 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 Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as an annotated PDF electronic file and scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.6 RECORD PRODUCT DATA

- A. Recording: Maintain 1 copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as an annotated PDF electronic file and scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 - 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 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.
- B. Format: Submit miscellaneous record submittals as PDF electronic file and scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

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 for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
- B. Allowances: Furnish demonstration and training instruction time under the demonstration and training allowance as specified in Section 012100 "Allowances."

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit 1 digital copy within 7 days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.

- c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared in same format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

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

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.

- d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
2. Documentation: Review the following items in detail:
- a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
- a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
- a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Instructions for identifying parts and components.
 - c. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. 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 furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner through Architect with at least 7 days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- 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.

- E. Cleanup: Collect used and leftover educational materials and remove from Project. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified videographer to record demonstration and training video recordings. 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. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings on a thumb drive or by uploading to web-based Project software site.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone or dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 017900

SECTION 033000 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes. B. Related Requirements:

1. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
2. Section 035300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.
3. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
4. Section 321313 "Concrete Paving" for concrete pavement and walks.
5. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 1. Before submitting design mixtures, review concrete design mixture 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 mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.

- e. Special concrete finish Subcontractor.
- 2. Review special inspection and testing and inspecting agency procedures for field quality control, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect. E.

Samples: For waterstops vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturer testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.

7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: 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. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

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.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

- A. 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 average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 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 mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that 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. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 3. Overlaid Finnish birch plywood.
- 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, leave holes no 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.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," 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 steel wire or CRSI Class 2 stainless-steel bar supports.
 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
2. Fly Ash: ASTM C 618, Class F.

3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
 4. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Master Builders Solutions.
 - c. Sika Corporation.
- G. Permeability-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aquafin, Inc.
 - b. Kryton International Inc.
 - c. Xypex Chemical Corporation.
2. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRD C48 at a hydraulic pressure of 200 psi for 14 days.

H. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Williams Products, Inc.
 2. Profile: Flat dumbbell with center bulb.
 3. Dimensions: 6 inches by 3/8 inch thick; nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 1. Profile: Flat dumbbell with center bulb.
 2. Dimensions: 6 inches by 3/8 inch thick; nontapered.

2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, 15 mil minimum thickness Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.8 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 1. Manufacturers: Subject to compliance with requirements,:
 - a. ChemMasters, Inc.

- b. ChemTec International.
- c. Euclid Chemical Company (The); an RPM company.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ChemMasters, Inc.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. SpecChem, LLC.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Kaufman Products, Inc.
 - c. SpecChem, LLC.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Kaufman Products, Inc.
 - c. Master Builders Solutions.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Kaufman Products, Inc.
 - c. SpecChem, LLC.
 - H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Kaufman Products, Inc.
 - c. SpecChem, LLC.
 - I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. Kaufman Products, Inc.
 - c. SpecChem, LLC.
- 2.10 RELATED MATERIALS
- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
 - B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
 - C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, 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 suitable for application temperature and of grade to suit requirements, and as follows:
 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - E. Reglets: Fabricate reglets of not less than 0.022-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 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 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/C 150M, 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 Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150/C 150M, 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.

2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.
 2. Combined Fly Ash and Pozzolan: 25 percent.
 3. Slag Cement: 50 percent.
 4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 5. Silica Fume: 10 percent.
 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing high-range water-reducing or plasticizing admixture 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 w/c ratio below 0.50.
 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Dry Shrinkage: 0.05% when tested in accordance with ASTM C157.
 3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- B. Foundation Walls: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Dry Shrinkage: 0.05% when tested in accordance with ASTM C157.
3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Dry Shrinkage: 0.05% when tested in accordance with ASTM C157.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd..
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Suspended Slabs: Normal-weight concrete.

1. Minimum Compressive Strength : 3000 psi at 28 days.
2. Minimum Compressive Strength of the concrete at the storm shelter roof to be 5000 psi (34.5 MPa) concrete.
3. Maximum Dry Shrinkage: 0.05% when tested in accordance with ASTM C157.
4. Minimum Cementitious Materials Content: 540 lb/cu. yd..
5. Slump Limit: 4 inches, plus or minus 1 inch.
6. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, 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: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 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, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- 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 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 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct 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.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.

2. 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. Do not 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 ITEM INSTALLATION

- 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 rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. 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. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. 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 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- 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-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

3.6 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. 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.

- 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. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement 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.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

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 keyed joints as 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-fourth 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 when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- 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 Section 079200 "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. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

- 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 are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth not to 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.
- E. 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, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces not exposed to public view.
- 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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view,.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.

Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. 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 ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. 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 to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling 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 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 and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, 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 ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases 6 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
 3. Minimum Compressive Strength: 4000 psi at 28 days.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.

6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING 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 ACI 301 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 for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
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 certifies does not interfere with bonding of floor covering used on Project.
- 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.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- 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 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than seven days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 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 one month(s). 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 joints clean and dry.
- C. Install semirigid 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.

3.16 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 1 part portland cement to 2-1/2 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 to solid concrete. Limit cut depth to 3/4 inch. 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 matches 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 a 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 mixture 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.

3.17 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and 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 welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.

- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture 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 mixture placed each day.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, 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 mixture.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
 6. Unit Weight: ASTM C 567/C 567M, 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 mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure five (5) standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days and one set of three specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 10. 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 mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

11. 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.
12. 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/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

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. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Pre-faced concrete masonry units.
 - 4. Mortar and grout.
 - 5. Steel reinforcing bars.
 - 6. Masonry-joint reinforcement.
 - 7. Embedded flashing.
 - 8. Miscellaneous masonry accessories.
 - 9. Masonry-cell fill.

- B. Related Requirements:

- 1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
 - 2. Section 071900 "Water Repellents" for water repellents applied to unit masonry assemblies.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Sustainable Design Submittals:
- C. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties and material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 - 2. Integral water repellant used in CMUs.
 - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 4. Mortar admixtures.
 - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 6. Grout mixes. Include description of type and proportions of ingredients.
 - 7. Reinforcing bars.
 - 8. Joint reinforcement.
 - 9. Anchors, ties, and metal accessories.
- 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 C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 - 2. Include test reports, according to ASTM C 1019, 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 TMS 602/ACI 530.1/ASCE 6.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- 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. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. 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.

- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
- C. CMUs: ASTM C 90.
 - 1. Density Classification: Normal weight.
 - 2. Size (Width): Manufactured to dimensions **3/8 inch (10 mm)** less-than-nominal dimensions.
 - 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.5 MASONRY LINTELS

- A. General: Provide one of the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than **1/4 inch (6 mm)** thick, use aggregate graded with 100 percent passing the **No. 16 (1.18-mm)** sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- E. Aggregate for Grout: ASTM C 404.
- F. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. GCP Applied Technologies Inc.
- H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACM Chemistries.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. GCP Applied Technologies Inc.

- I. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, **Grade 60 (Grade 420)**.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from **0.148-inch (3.77-mm)** steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Heckmann Building Products, Inc.
 - b. Hohmann & Barnard, Inc.
 - c. Wire-Bond.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.
- 1. Interior Walls: Hot-dip galvanized carbon steel.
 - 2. Wire Size for Side Rods: **0.187-inch (4.76-mm)** diameter.
 - 3. Wire Size for Cross Rods: **0.187-inch (4.76-mm)** diameter.
 - 4. Spacing of Cross Rods: Not more than **16 inches (407 mm)** o.c.
 - 5. Provide in lengths of not less than **10 feet (3 m)**, with prefabricated corner and tee units.

2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least **1-1/2 inches (38 mm)** into masonry but with at least a **5/8-inch (16-mm)** cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
- 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. For reinforced masonry, use portland cement-lime mortar.
 - 4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- C. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
 - 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
- D. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
 - 1. Application: Use epoxy pointing mortar for exposed mortar joints with pre-faced CMUs.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus **1/2 inch (12 mm)** or minus **1/4 inch (6 mm)**.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus **1/2 inch (12 mm)**.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus **1/4 inch (6 mm)** in a story height or **1/2 inch (12 mm)** total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than **1/4 inch in 10 feet (6 mm in 3 m)**, or **1/2-inch (12-mm)** maximum.

2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2-inch (12-mm)** maximum.
3. For vertical lines and surfaces do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (9 mm in 6 m)**, or **1/2-inch (12-mm)** maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2-inch (12-mm)** maximum.
5. For lines and surfaces, do not vary from straight by more than **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (9 mm in 6 m)**, or **1/2-inch (12-mm)** maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, or **1/2-inch (12-mm)** maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than **1/16 inch (1.5 mm)**.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**, with a maximum thickness limited to **1/2 inch (12 mm)**.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3 mm)**.
3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch (9 mm)** or minus **1/4 inch (6 mm)**.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **4 inches (100 mm)**. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout **24 inches (600 mm)** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide **1/2-inch (13-mm)** clearance between end of anchor rod and end of tube. Space anchors **48 inches (1200 mm)** o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- D. Rake out mortar joints at pre-faced CMUs to a uniform depth of **1/4 inch (6 mm)** and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch (16 mm)** on exterior side of walls, **1/2 inch (13 mm)** elsewhere. Lap reinforcement a minimum of **6 inches (150 mm)**.
 - 1. Space reinforcement not more than **16 inches (406 mm)** o.c.
 - 2. Space reinforcement not more than **8 inches (203 mm)** o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than **8 inches (203 mm)** above and below wall openings and extending **12 inches (305 mm)** beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than **1 inch (25 mm)** wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than **24 inches (610 mm)** o.c. vertically and **36 inches (915 mm)** o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.

5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than **60 inches (1520 mm)**.

3.12 FIELD QUALITY CONTROL

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

- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- F. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Concrete masonry units.
3. Mortar materials.
4. Ties and anchors.
5. Embedded flashing.
6. Accessories.
7. Mortar mixes.

B. Products Installed but not Furnished under This Section:

1. Cast-stone trim in masonry veneer.
2. Steel lintels in masonry veneer.
3. Steel shelf angles for supporting masonry veneer.
4. Calcium silicate manufactured stone veneer.

C. Related Requirements:

1. Section 047313 "Calcium Silicate Manufactured Stone Masonry" for stone trim set as anchored veneer.
2. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 071900 "Water Repellents" for water repellents applied to unit masonry assemblies.
4. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 ALLOWANCES

- ##### A.
- See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 DEFINITIONS

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

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection: Clay face brick.
- D. Samples for Verification: For each type and color of the following:
 - 1. Clay face brick, in the form of straps of 5 or more bricks.
 - 2. Weep/cavity vents.
 - 3. Cavity drainage material.
 - 4. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
 - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Anchors, ties, and metal accessories.

- C. Qualification Statements: For testing agency.
- D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.

1.8 MOCKUPS

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness.
 - 2. Build sample panels facing south.
 - 3. Clean exposed faces of panels with masonry cleaner indicated.
 - 4. Protect approved sample panels from the elements with weather-resistant membrane.
 - 5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

1.9 DELIVERY, STORAGE, AND HANDLING

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

- B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with 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.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain exposed masonry units from single source.
- B. For exposed masonry units, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction.

2.3 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area), Grade SW, Type FBS or HBS.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Acme Brick Company.
 - b. Belden Brick Company (The).
 - c. Boral Bricks, Inc; Boral Limited.
 - d. Endicott Clay Products Co.
 - e. General Shale Brick, Inc.
 - f. Glen-Gery Corporation.
 - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
 - 3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 - 4. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-1/2 inches long.
 - 5. Application: Use where brick is exposed unless otherwise indicated.
 - 6. Color and Texture: As selected by Architect.

2.4 CONCRETE MASONRY UNITS

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

2.5 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Argos USA LLC.
 - b. Cemex S.A.B. de C.V.
 - c. Fairborn Cement Company.
 - d. Federal White Cement, Ltd.
 - e. Holcim (US) Inc.
 - f. Lafarge North America Inc.
 - g. Lehigh Hanson; HeidelbergCement Group.
 - h. Lehigh White Cement Company.
 - i. Quikrete; The QUIKRETE Companies, LLC.
 - j. Sakrete; CRH Americas, Oldcastle APG.
- E. Mortar Cement: ASTM C1329/C1329M.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Lafarge North America Inc.

F. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime, masonry cement, or mortar cement, sand, and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- 1) Amerimix.
- 2) Quikrete.
- 3) SAKRETE of North America LLC.
- 4) Spec Mix, LLC.

2. Preblended Dry Masonry Cement Mortar Mix

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- 1) Amerimix.
- 2) Spec Mix, LLC.

G. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C1384, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Euclid Chemical Company (The); an RPM company.
- b. GCP Applied Technologies Inc.

I. Water: Potable.

2.6 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized-steel wire.
- D. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16-inch.
 - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.1084-inch-thick steel sheet, galvanized after fabrication.
 - 3. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 - 4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
 - 5. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie and washer at face of insulation.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) FERO Corporation.
 - 2) Hohmann & Barnard, Inc.
 - 3) PROSOCO, Inc.
 - 4) Wire-Bond.
 - 6. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double-pintle wire tie.

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Quality Steel and Wire LLC.
 - 4) Wire-Bond.
7. Masonry-Veneer Anchors; Slotted Plate: Sheet metal anchor section, with screw holes at top and bottom; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. Use self-adhering tape to seal penetration behind anchor plate.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Quality Steel and Wire LLC.
 - 4) Wire-Bond.
8. Masonry-Veneer Anchors; Slotted Plate with Prongs: Sheet metal anchor section, with screw holes at top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. Use self-adhering tape to seal penetration behind anchor plate.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Hohmann & Barnard, Inc.
 - 2) Wire-Bond.
9. Masonry-Veneer Anchors; Single-Barrel Screw: Self-drilling, single-barrel screw designed to receive wire tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing and a coating to reduce thermal conductivity.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Rodenhouse Inc.
 - 4) Wire-Bond.

10. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with thermally resistant wingnut head designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation with factory-installed gasketed washer to seal at face of insulation and sheathing and a coating to reduce thermal conductivity.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
11. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.
12. Stainless-Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than 3 exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank.

2.7 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016-inch thick.
 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Cheney Flashing Company.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keystone Flashing Company, Inc.
 3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2-inch out from wall, with outer edge bent down 30 degrees and hemmed.
 5. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2-inch out from wall, with outer edge bent down 30 degrees and hemmed.

6. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
7. Solder metal items at corners.
8. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 40 mil thick.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Firestone Specialty Products.
 - 3) Heckmann Building Products, Inc.
 - 4) Hohmann & Barnard, Inc.
 - 5) Wire-Bond.

B. Drainage Plane Flashing: Fabricate from stainless steel and/or elastomeric membrane and drainage membrane to shapes indicated, including weep tabs, termination bar and drip edge. Provide flashing materials as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Mortar Net Solutions.
 - b. STS Coatings, Inc.
 - c. York Manufacturing, Inc.
2. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016-inch thick.
3. Elastomeric Membrane: EPDM complying with ASTM D4637/D4637M, 40 mil.
4. Fabricate continuous flashings in sections 60 inches long, minimum.
5. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

D. Termination Bars for Flexible Flashing: Stainless-steel steel bars 0.075-inch by 1 inch.

2.8 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Weep/Vent Products: Use 1 of the following unless otherwise indicated:
 1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.

2. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8- by 1-1/2 by 3-1/2 inches long.
 3. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8-inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Advanced Building Products Inc.
 - 2) Heckmann Building Products, Inc.
 - 3) Hohmann & Barnard, Inc.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond.
 4. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8-inch less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) CavClear; a division of Archovations, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keene Building Products.
 - 4) Mortar Net Solutions.
 5. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Hohmann & Barnard, Inc.
 - 2) Williams Products, Inc.
 - 3) Wire-Bond.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Mortar Deflector: Strips, 3/4-inch thick and 10 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Advanced Building Products Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Keene Building Products.
 - 4) Mortar Net Solutions.
 - 5) Wire-Bond.
 - 6) York Manufacturing, Inc.
- D. Proprietary Acidic Masonry Cleaner: 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.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
 - b. EaCo Chem, Inc.
 - c. PROSOCO, Inc.

2.9 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.
 - 3. For exterior masonry, use portland cement-lime, masonry cement, or mortar cement mortar.
 - 4. For reinforced masonry, use portland cement-lime, masonry cement, or mortar cement mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2-inch or minus 1/4-inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2-inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16-inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16-inch from 1 masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-In Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Lay hollow brick and CMUs with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 - 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- C. Set cast-stone trim units in full bed of mortar with full vertical joints.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Wet joint surfaces thoroughly before applying mortar.
 - 3. Rake out mortar joints for pointing with sealant.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing and masonry backup with metal fasteners of type indicated. Use 2 fasteners unless anchor design only uses 1 fastener.
 - 2. Embed tie sections in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
 - 5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 - 6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel, where masonry abuts or faces structural steel to comply with the following:
 1. Provide an open space not less than 1 inch wide between masonry and structural steel unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints as follows:
 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.
 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8-inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8-inch.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

- A. Install steel lintels where indicated.
- B. Provide offset angle supports where indicate and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.

- C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar as shown in the Drawings or per manufacturer.
 - 3. At lintels and shelf angles, extend flashing 6 inches minimum at each end. At heads and sills, extend flashing 6 inches minimum and turn ends up not less than 2 inches to form end dams.
 - 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2-inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
- C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.
- D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use specified weep/cavity vent products to form weep holes.
 - 2. Space weep holes 24 inches o.c. unless otherwise indicated.
 - 3. Space weep holes formed from plastic tubing 16 inches o.c.
 - 4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.11 FIELD QUALITY CONTROL

- A. Inspections: Special inspections in accordance with Level 2 in TMS 402.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- B. Testing Prior to Construction: One set of tests.
- C. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- D. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

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Fire Station
Lee's Summit, Missouri

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

SECTION 044313.13 - ANCHORED STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quarried stone masonry anchored to unit masonry backup as a veneer.
2. Quarried stone masonry anchored to cold-formed metal framing and sheathing as a veneer.

B. Products Installed but Not Furnished under This Section Include:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Requirements: Section 042000 "Unit Masonry" for concealed flashing, horizontal joint reinforcement, and veneer anchors.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Samples for Initial Selection: For colored mortar and other items involving color selection.

C. Samples for Verification:

1. For each stone type indicated. Include at least 2 Samples in each set and show the full range of color and other visual characteristics in completed Work.
2. For each color of mortar required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, supply sources, and other information as required to identify materials used. Include mix proportions for mortar and source of aggregates.

1. Neither receipt of list nor approval of mockups constitutes approval of deviations from the Contract Documents contained in mockups unless Architect approves such deviations in writing.

C. Material Test Reports:

1. Stone Test Reports: For stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous 3 years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.
- B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
 - a. Include stone coping at top of mockup.
 - b. Include a sealant-filled joint at least 16 inches long in mockup.
 - c. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit stone masonry above half of flashing).
 - d. Include metal studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.
 2. Protect accepted mockups from the elements with weather-resistant membrane.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.
- B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.
 - 1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the 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 end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degrees F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.8 COORDINATION

- A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from single quarry, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

2.2 LIMESTONE MASONRY UNITS

- A. Material Standard: Comply with ASTM C568/C568M.
 - 1. Classification: III High Density.
- B. Description: Natural dolomitic limestone that has been selected, trimmed or cut to specified or indicated shapes or sizes, with or without 1 or more mechanically dressed faces.
- C. Material: Subject to compliance with requirements, available stone varieties that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Arriscraft.
- D. Varieties and Sources: Dense, dolomitic limestone, quarried from the Amabel formation in the Bruce Peninsula near Wiarton, Ontario, Canada.

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.
 - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Cement: ASTM C1329/C1329M.
- E. Masonry Cement: ASTM C91/C91M.

- F. 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.
- G. Water: Potable.

2.4 VENEER ANCHORS

- A. Refer to Section 042000 "Unit Masonry" for veneer anchors.

2.5 EMBEDDED FLASHING MATERIALS

- A. Refer to Section 042000 "Unit Masonry" for embedded flashing materials.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Refer to Section 042000 "Unit Masonry" for compressible filler.
- B. Cementitious Dampproofing for Limestone: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.
- C. Weep/Vent Products: Refer to Section 042000 "Unit Masonry" for weep/vent products.
- D. Cavity Drainage Material: Refer to Section 042000 "Unit Masonry" for cavity drainage material.

2.7 MASONRY CLEANERS

- A. Acid-Based Cleaner: Manufacturer's standard acidic new masonry cleaner composed of buffered hydrochloric acid. Verify compatibility with selected masonry product and mortar and adjacent construction.
 - 1. NMD 80 manufactured by EaCo Chem, Inc.; New Castle, PA; www.eacochem.com.
 - 2. Or approved equal.
- B. Non-Hydrochloric Acid-Based Cleaner: Manufacturer's standard non-hydrochloric acidic new masonry cleaner composed of organic salts. Verify compatibility with selected masonry product and mortar and adjacent construction.
 - 1. SOS 50 manufactured by EaCo Chem, Inc.; New Castle, PA; www.eacochem.com.
 - 2. Or approved equal.

2.8 FABRICATION

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 - 1. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
- B. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Cut and drill sinkages and holes in stone for anchors and supports.
- E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.
 - 1. Clean sawed backs of stone to remove rust stains and iron particles.

2.9 MORTAR MIXES

- A. Refer to Section 042000 "Unit Masonry" for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Examine substrate to verify that inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.
- C. Examine wall framing, sheathing, and weather-resistant barrier to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Accurately mark stud centerlines on face of weather-resistant barrier before beginning stone installation.
- B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 INSTALLATION OF STONE MASONRY

- A. Perform necessary field cutting and trimming as stone is set.
 - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
- B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- D. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.
- E. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
- F. Install steel lintels where indicated. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
- G. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 3/8-inch at narrowest points or more than 3/8-inch at widest points.
- H. Provide sealant joints of widths and at locations indicated.
 - 1. Keep sealant joints free of mortar and other rigid materials.
 - 2. Sealant joints are specified in Section 079200 "Joint Sealants."
- I. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
 - 1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 8 inches, and behind weather barrier.

2. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 8 inches, and extend into or through inner wythe to comply with requirements in Section 042000 "Unit Masonry."
 3. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
 4. At sills, extend flashing not less than 4 inches at ends.
 5. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
 6. Extend sheet metal flashing 1/2-inch beyond masonry face at exterior, and turn flashing down to form a drip.
 7. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2-inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.
- J. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.
1. Use round plastic tubing to form weep holes.
 2. Space weep holes 24 inches o.c.
 3. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- K. Install vents in head joints at top of each continuous cavity at spacing indicated. Use mesh weep holes/vents to form vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.
- L. Coat Limestone with Cementitious Dampproofing as Follows:
1. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4-inch in 20 feet or 1/2-inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4-inch in 20 feet or 1/2-inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2-inch in 20 feet or 3/4-inch in 40 feet or more.
- D. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.
- B. Anchor stone masonry to unit masonry with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors to unit masonry with 2 screws.
- C. Anchor stone masonry to stud framing with adjustable, screw-attached veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with 2 screws.
- D. Anchor stone masonry to stud framing with screw-attached veneer anchors unless otherwise indicated.
- E. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
- F. Space anchors to provide not less than 1 anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- G. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- H. Provide 1-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.
 - 1. Slope beds toward cavity to minimize mortar protrusions into cavity.
 - 2. Do not attempt to trowel or remove mortar fins protruding into cavity.
- I. Rake out joints for pointing with mortar to depth of not less than 1/2-inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8-inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8-inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
 - 1. Joint Profile: Concave.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
 - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
 - 2. Defective joints.
 - 3. Stone masonry not matching approved samples and mockups.
 - 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
 - 5. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.
 - 6. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.8 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313.13

SECTION 047200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trim units.
2. Mortar materials.
3. Accessories.

- B. Related Requirements: Section 042613 "Masonry Veneer" for Project conditions, source limitations for mortar materials, mortar materials, mortar mixes, proprietary acidic cleaners, installation tolerances, and adjusting and cleaning.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

- C. Samples for Verification: For each shape required, 4 inches.

- D. Full-Size Samples: For each trim shape of cast stone unit required.

1. Make available for Architect's review at Project site.
2. Approved Samples may be installed in the Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1. Include copies of material test reports, indicating compliance of cast stone with ASTM C1364.

- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364.

- 1. Provide test reports based on testing within previous 6 months.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by CSI (Cast Stone Institute).

- B. Furnish cast stone for installation in mockups specified in Section 042613 "Masonry Veneer."

- 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless Architect specifically approves such deviations in writing.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work.

- B. Pack, handle, and ship cast stone units in suitable packs or pallets.

- 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
 - 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

- A. Refer to Section 042613 "Masonry Veneer" for Project conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.
- B. Source Limitations for Mortar Materials: Refer to Section 042613 "Masonry Veneer" for source limitations for mortar materials.

2.2 CAST STONE MATERIALS

- A. General: Comply with ASTM C1364.
- B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast stone color indicated.
- C. Coarse Aggregates: Limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast stone textures and colors.
- E. Admixtures: Use only admixtures specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1-percent, water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Air-Entraining Admixture: ASTM C260/C260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
 - 4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 5. Water-Reducing, Retarding Admixture: ASTM C494/C494M, Type D.
 - 6. Water-Reducing, Accelerating Admixture: ASTM C494/C494M, Type E.
- F. Reinforcement:
 - 1. Deformed steel bars complying with ASTM A615/A615M, Grade 40. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.
 - a. Epoxy Coating: ASTM A775/A775M.
 - b. Galvanized Coating: ASTM A767/A767M.
 - 2. Fiber Reinforcement: ASTM C1116/C1116M.

- G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 304.

2.3 CAST STONE UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Architectural Cast Stone; West Chicago, Illinois.
 2. Architectural Cast Stone, Inc.; Wichita, Kansas.
 3. Arriscraft; Arris-Cast.
 4. Caliber Cast Stone; O'Fallon, Missouri.
 5. Midwest Cast Stone, Inc.; Kansas City, Kansas.
- B. Cast Stone Units: Comply with ASTM C1364.
1. Units are manufactured using the manufacturer's selected method.
 2. Trim units including window sills.
- C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces to drain as indicated.
 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 3. Provide drips on projecting elements unless otherwise indicated.
- D. Fabrication Tolerances:
1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8-inch.
 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8-inch, whichever is greater, but in no case by more than 1/4-inch.
 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8-inch, whichever is greater.
 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8-inch on formed surfaces of units and 3/8-inch on unformed surfaces.
- E. Cure Units as Follows:
1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 degrees F for 12 hours, or 70 degrees F for 16 hours.
 2. Keep units damp and continue curing to comply with 1 of the following:
 - a. No fewer than 5 days at mean daily temperature of 70 degrees F or above.
 - b. No fewer than 7 days at mean daily temperature of 50 degrees F or above.
- F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

- G. Colors and Textures: As selected by Architect from manufacturer's full range.

2.4 MORTAR MATERIALS

- A. Provide mortar materials that comply with Section 042613 "Masonry Veneer."

2.5 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.
- B. Dowels: 1/2-inch-diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.
- C. Proprietary Acidic Cleaner: Refer to Section 042613 "042613 "Masonry Veneer" for proprietary acidic cleaner.

2.6 MORTAR MIXES

- A. Comply with requirements in Section 042613 "Masonry Veneer" for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

- A. Set cast stone as indicated in TMS 604.
- B. Install cast stone units to comply with requirements in Section 042613 "Masonry Veneer."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. Set cast stone as indicated in TMS 604.

- B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- C. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.
- D. Fill anchor holes with sealant.
 - 1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
 - 1. Form open joint of width indicated, but not less than 3/8-inch.
- F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

- A. Refer to Section 042613 "Masonry Veneer" for installation tolerances.

3.5 ADJUSTING AND CLEANING

- A. Refer to Section 04613 "Masonry Veneer" for adjusting and cleaning.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

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. Structural steel.
 - 2. Grout.

- B. Related Requirements:

- 1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
 - 2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
 - 3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.

1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment Drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:
 - 1. Power source (constant current or constant voltage).
 - 2. Electrode manufacturer and trade name, for demand critical welds.
- D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation licensed in the same State as the Project.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, shop-painting applicators, professional engineer, & testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shop primers.
 - 5. Nonshrink grout.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P2 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by

AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC 360
 - 2. Use Load and Resistance Factor Design; data are given at factored-load level
- B. Moment Connections: Type FR, fully restrained.

C. STRUCTURAL-STEEL MATERIALS

D. W-Shapes: ASTM A 992/A 992M.

E. Channels, Angles, M , S-Shapes: ASTM A 36/A 36M.

F. Plate and Bar: ASTM A 36/A 36M.

G. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.

H. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

I. Steel Forgings: ASTM A 668/A 668M.

J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating.

2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating] finish.

C. 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: Plain.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.

2. Nuts: ASTM A 563 heavy-hex carbon steel.

3. Plate Washers: ASTM A 36/A 36M carbon steel.

4. Washers: ASTM F 436, Type 1, hardened carbon steel.

5. Finish: Plain.

2.3 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

- F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- G. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 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 of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.
 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 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 two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after 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.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.

- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.

- b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- c. Ultrasonic Inspection: ASTM E 164.
- d. Radiographic Inspection: ASTM E 94.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

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. Roof deck.
 - 2. Noncomposite form deck.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight structural concrete fill over steel deck.
 - 2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Section 099113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
 - 5. Section 099123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.

- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.
- C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- D. Evaluation Reports: For steel deck, from ICC-ES.
- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; 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 the listings of another qualified testing agency.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Canam Steel Corporation; Canam Group, Inc.
 2. New Millennium Building Systems, LLC.
 3. Nucor Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 50 (275) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 2. Deck Profile: As indicated.
 3. Profile Depth: 1-1/2 inches.
 4. Design Uncoated-Steel Thickness: 0.0358 inch.
 5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: 0.0358/0.0474 inch.
 6. Span Condition: Triple span or more.
 7. Side Laps: Overlapped.

2.3 NONCOMPOSITE FORM DECK

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Canam Steel Corporation; Canam Group, Inc.
 2. New Millennium Building Systems, LLC.
 3. Nucor Corporation.
- B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 (275) minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.
5. Side Laps: Overlapped

2.4 ACCESSORIES

- A. General: 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 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, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: ASTM A 780/A 780M.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

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 according to applicable specifications and commentary in SDI Publication No. 31, 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.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. 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, and as follows unless otherwise noted:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

2.

- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- C. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. 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.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members 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 (914 mm), and as follows unless noted otherwise:
 - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- 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** .
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to 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. Diaphragm attachment.
- C. Field welds will be subject to inspection.
- D. Prepare test and inspection reports.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 053100

SECTION 054000 - 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
3. Roof rafter framing.
4. Ceiling joist framing.
5. Soffit framing.

- B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing including detailed analysis and design calculations for members and connections, signed and sealed by the professional engineer responsible for their production and licensed in the same State as the Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ClarkDietrich.
 - 2. Steel Structural Systems.
 - 3. The Steel Network, Inc.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a.
 - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.

- c. Interior Non-Load-Bearing Framing: Horizontal deflection of $1/240$ of the wall height under a horizontal load of 5 lbf/sq. ft..
 - d. Roof Rafter Framing: Vertical deflection of $1/240$ of the horizontally projected span for live loads.
 - e. Ceiling Joist Framing: Vertical deflection of $1/360$ of the span for live loads and $1/240$ for total loads of the span.
 - f. Support Members Around Openings: 0.5 inches in the vertical and horizontal unless more stringent requirements are necessary per the manufacturer of the element being used to fill the opening.
- 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope 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.
- 4. 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.
- 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
- D. Fire-Resistance Ratings: Comply with ASTM E 119; 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 the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
 2. Coating: G60, A60, AZ50, or GF30.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
 2. Coating: G60.

2.4 EXTERIOR 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: Matching steel studs.
 2. Flange Width: 1-1/4 inches minimum.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich.
 - b. Simpson Strong-Tie Co., Inc.
 - c. Steel Construction Systems.
- 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 loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1 inch plus the design gap for one-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 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 one-story structures.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: Insert dimension 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 through positive mechanical attachment to stud web and structure.

2.5 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: 1-3/8 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 minimum.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich.
 - b. SCAFCO Steel Stud Company.

c. Simpson Strong-Tie Co., 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 loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1 inch plus the design gap for one-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 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 one-story structures.
 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch.
 - b. Flange Width: .
- 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 through positive mechanical attachment to stud web and structure.

2.6 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, **unpunched**, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).
 2. Flange Width: 1-5/8 inches (41 mm), minimum.

2.7 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0329 inch.

2. Flange Width: 1-5/8 inches, minimum.

2.8 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation 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 and knee braces.
 9. Joist hangers and end closures.
 10. Hole-reinforcing plates.
 11. Backer plates.

2.9 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/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
 1. Uses: Securing cold-formed steel framing to structure.

2. Type: Torque-controlled expansion anchor Torque-controlled adhesive anchor or adhesive anchor.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.10 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.
- B. Cement Grout: Portland cement, ASTM C 150/C 150M, 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: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- 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 as required.

2.11 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, 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 steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M 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 screws penetrating joined members by no fewer than three exposed screw threads.
 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable 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 steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, 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 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 required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, 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 steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- 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 equal 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 joints with cold-formed steel framing. Independently frame both sides of joints.

- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly 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 approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- 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 deep-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 or infill studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap 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.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: 16 inches.
- 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 deep-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 studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap 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.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 1. Install solid blocking at centers indicated on Shop Drawings.

- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

- A. Install cold-formed steel 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.

3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 054400 - COLD-FORMED METAL TRUSSES

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 cold-formed steel framing in the form of the following:
 - 1. Cold-formed steel trusses for roofs.
 - 2. Cold-formed steel trusses for floors.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for cold-formed steel studs, joists, and rafters.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel trusses including detailed analysis and design calculations, signed and sealed by the professional engineer responsible for their production and licensed in the same State as the Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Miscellaneous structural clips and accessories.
- D. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- E. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
 - 1. Alpine TrusSteel; an ITW company.

2. [USA Frametek.](#)
3. [WESTCO Steel Systems, Inc.](#)

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel trusses.
- B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.
 1. Design Loads: As indicated on Drawings.
 2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
 - a. Floor Trusses: Vertical deflection of 1/480 for live loads and 1/360 for total loads of the span.
 - b. Roof Trusses: Vertical deflection of 1/360 of the span.
 3. Design trusses to provide for movement of truss members located outside the insulated building envelope 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 (67 deg C).
- C. Cold-Formed Steel Truss Standards: Unless more stringent requirements are indicated, trusses shall comply with the following:
 1. Floor and Roof Systems: AISI S210.
 2. Lateral Design: AISI S213.
 3. Roof Trusses: AISI S214.
- D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Indicate design designations from UL or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL TRUSS MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 1. Grade: As required by structural performance.

2. Coating: G90 or equivalent.

2.4 ROOF TRUSSES

- A. Roof Truss Members: Manufacturer's standard C-shaped steel sections or as required to provide an economical design.
 1. Connecting Flange Width: 1-5/8 inches, minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
 2. Minimum Base-Metal Thickness: 0.0538 inch.
 3. Section Properties: As required by design.

2.5 FLOOR TRUSSES

- A. Floor Truss Members: Manufacturer's standard C-shaped steel sections or as required to provide an economical design.
 1. Connecting Flange Width: 1-5/8 inches (41 mm), minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
 2. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).

2.6 TRUSS ACCESSORIES

- A. Fabricate steel-truss accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for truss members.
- B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.7 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/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on

ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel trusses to structure.
 2. Type: As required by design.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Power-Actuated Fasteners: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20.
- B. Shims: Load-bearing, high-density multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as truss members supported by shims.

2.9 FABRICATION

- A. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate trusses using jigs or templates.
 2. Cut truss members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

4. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:
 1. Spacing: Space individual truss members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting trusses and 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 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 steel trusses without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. Install bridge, and brace cold-formed steel trusses according to AISI S200, AISI S202, AISI S214, and manufacturer's written instructions unless more stringent requirements are indicated.
 1. Coordinate with wall framing to align webs of bottom chords and load-bearing studs or continuously reinforce track to transfer loads to structure.
 2. Anchor trusses securely at all bearing points.

3. Install continuous bridging and permanently brace trusses as indicated on Shop Drawings and designed according to CFSEI's Technical Note 551e, "Design Guide: Permanent Bracing of Cold-Formed Steel Trusses." .
- B. Install cold-formed steel trusses and accessories true to line and location, and with connections securely fastened.
 1. Erect trusses with plane of truss webs plumb and parallel to each other. Align and accurately position trusses at required spacings.
 2. Erect trusses without damaging truss members or connections.
 3. Fasten cold-formed steel trusses by welding or mechanical fasteners.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- C. Install temporary bracing and supports to secure trusses and support loads equal 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 trusses are secured.
- D. Truss Spacing: Max. 24 inches As indicated on Drawings.
- E. Do not alter, cut, or remove truss members or connections of trusses.

3.4 ERECTION TOLERANCES

- A. Install cold-formed steel trusses level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Cold-Formed Steel Trusses Spanning 60 ft. (18,288 mm) or Longer: Verify temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed according to the approved truss submittal package.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- C. Cold-formed metal trusses will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel trusses with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel trusses are without damage or deterioration at time of Substantial Completion.

END OF SECTION 054400

SECTION 055000 - METAL FABRICATIONS

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. Steel framing and supports for ceiling-hung toilet compartments.
2. Steel framing and supports for operable partitions.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Elevator machine beams, hoist beams,.
7. Steel shapes for supporting elevator door sills.
8. Metal ladders.
9. Loose bearing and leveling plates for applications where they are not specified in other Sections.
10. Steel weld plates and angles for casting into concrete not specified in other Sections.
11. Miscellaneous steel trim including steel angle corner guards.
12. Metal bollards with covers.

- B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections. C. Related Requirements:
 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 3. Section 051200 "Structural Steel Framing."

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for mechanical, electrical, and plumbing equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Elevator machine beams, hoist beams,.
 - 4. Metal ladders.
- C. Delegated-Design Submittal: For ladders and mechanical, electrical, plumbing equipment supports, including detailed analysis and design data form members and connections, signed and sealed by the qualified professional engineer registered in the same State as the Project responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders and mechanical, electrical, and plumbing equipment supports.
- B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.
- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 2.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal weight, air-entrained, concrete with a minimum 28-day compressive strength of 4000 psi (20 MPa).

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated or required.
- D. Prime miscellaneous framing and supports with primer as required per Section 051200 "Structural Steel Framing".

2.7 METAL LADDERS

- A. General:
1. Comply with ANSI A14.3, except for elevator pit ladders.
 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch-diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Harsco Industrial IKG, a division of Harsco Corporation.
 - 2) W.S. Molnar Company.
7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Galvanize and prime exterior ladders, including brackets.

C. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fixfast USA.
 - b. O'Keeffe's Inc.
 - c. UPNOVR, Inc.
2. Space siderails 18 inches apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch deep and not less than 1/8 inch thick, with ribbed tread surfaces.
5. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
7. Provide minimum 72-inch-high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.

2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.

2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than 2 integrally welded steel strap anchors for embedding in concrete.

2.11 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.13 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

2.14 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
 - 1. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wiring.
 - 2. Install bollard covers prior to final Punch List. Provide products from 1 of the following:
 - a. Innoplast.
 - b. Interstate Products.
 - c. Quickswitch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

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. Preassembled steel stairs with concrete-filled treads
2. Steel tube railings attached to metal stairs.
3. Steel tube railings attached to walls and floors; Steel tube gates
4. Steel tube handrails attached to walls adjacent to metal stairs.

- B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Division 05 Section "Metal Fabrications" for metal treads and nosings installed at locations other than in metal stairs.
3. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.
4. Division 09 Section "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft. .
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in. .
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch , whichever is less.

- B. Structural Performance of Railings: Railings 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. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft. .
 - b. Infill load and other loads need not be assumed to act concurrently.

C. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor is 1.5.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 1. Prefilled metal-pan stair treads. Nonslip aggregates and nonslip aggregate finishes.
 2. Abrasive nosings.
 3. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 1. Provide templates for anchors and bolts specified for installation under other Sections.
 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes.
 1. Stair treads with nonslip aggregate surface finish.
 2. Metal floor plate treads.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Welding certificates.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs and railings.
 1. Test railings according ASTM E 894 and ASTM E 935.

1.6 QUALITY ASSURANCE

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. 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.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

- D. Wire Rod for Grating Crossbars: ASTM A 510 .
- E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- F. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 , unless another grade is required by design loads; exposed.

2.3 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Configuration: Cross-hatched units, **3 inches** wide without lip.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A ; with hex nuts, ASTM A 563 ; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 ; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be shop primed with zinc-rich primer.
- D. Machine Screws: ASME B18.6.3 .
- E. Lag Screws: ASME B18.2.1 .
- F. Plain Washers: Round, ASME B18.22.1 .
- G. Lock Washers: Helical, spring type, ASME B18.21.1 .
- H. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products:
 - a. ICI Devco Coatings; Catha-Coat 313.
 - b. Moore, Benjamin, & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - c. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - d. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
- D. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

A. Manufacturers:

1. Alfab, Inc.
2. American Stair, Inc.
3. Sharon Companies Ltd. (The)

B. Stair Framing:

1. Fabricate stringers of steel tubes.
 - a. Provide closures for exposed ends of tube stringers.
2. Construct platforms of steel channel headers and miscellaneous framing members as needed to comply with performance requirements.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.

2.8 STAIR RAILINGS

- A. Steel Tube Railings: Fabricate railings to comply with requirements indicated in drawings for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- C. Form changes in direction of railings as detailed.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.

- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Interior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs: SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

- 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
- B. Attach handrails to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For steel-framed partitions, use hanger or lag bolts set into fire retardant treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint is specified in Division 09 painting Sections.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

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: Steel pipe and tube railings.
- B. Related Sections: Section 321313 "Concrete Paving" for concrete paving and walks.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Steel: 72 percent of minimum yield strength.
 - 2. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
 - 3. Stainless Steel: 60 percent of minimum yield strength.
- C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf 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 acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages 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. Deliver such items to Project site in time for installation.
- C. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Tubing: ASTM A500 (cold formed).
- C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A36/A36M.

2.3 FASTENERS

- A. General: Provide the following:
 - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated.
- C. Fasteners for Interconnecting Railing Components: Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Shop Primers: Provide primers that comply with Section 099114 "Exterior Painting (MPI Standards)."
- E. Intermediate Coats and Topcoats: Provide products that comply with Section 099114 "Exterior Painting (MPI Standards)."
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

- A. General: Fabricate railings to comply with requirements 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 connections 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 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.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.

- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form changes in direction as follows:
 - 1. As detailed.
 - 2. By bending.
 - 3. By flush bends.
 - 4. By radius bends of radius indicated.
- J. 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.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- M. 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.
- N. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2-inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in

the same piece are not acceptable. 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.

- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
3. Comply with ASTM A123/A123M for hot-dip galvanized railings.
4. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
5. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
6. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

- D. Do not apply primer to galvanized surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.

- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16-inch in 3 feet.
3. 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.

- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

- 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 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.5 PROTECTION

- A. 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.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

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. Rooftop equipment bases and support curbs.
 - 2. Wood blocking, cants, and nailers.
 - 3. Wood furring and grounds.
 - 4. Plywood backing panels.
- B. Related Requirements:
 - 1. Division 06 Section "Sheathing."

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. SPIB: The Southern Pine Inspection Bureau.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Power-driven fasteners.
 4. Powder-actuated fasteners.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship" for the following:
 1. Miscellaneous lumber.

- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with

the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
 6. Grounds.
- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine; No. 3 grade; SPIB.

- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 .

2.7 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.

Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.

- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Plywood: Either DOC (U.S. Department of Commerce) PS1 or DOC PS2, unless otherwise indicated.
- C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- D. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
 - 1. Roof and wall sheathing within 48 inches of fire party walls.
 - 2. Roof sheathing.

2.5 WALL SHEATHING

- A. Plywood Sheathing: Exposure 1 sheathing.
 - 1. Span Rating: Not less than 16/0.
 - 2. Nominal Thickness: Not less than 1/2-inch.

B. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
 - a. CertainTeed; SAINT-GOBAIN.
 - b. Continental Building Products Inc.
 - c. Georgia-Pacific Gypsum LLC.
 - d. National Gypsum Company.
 - e. USG Corporation.
2. Type and Thickness: Regular, 1/2-inch thick.
3. Size: 48 by 120 inches for vertical installation.

2.6 ROOF SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 1/2-inch.

2.7 PARAPET SHEATHING

A. Plywood Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 1/2-inch.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than 0.0329-inch thick, use screws that comply with ASTM C1002.
 - 2. For steel framing from 0.033- to 0.112-inch thick, use screws that comply with ASTM C954.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than 3 support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall, parapet and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels 1/8-inch apart at edges and ends.

3.3 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than 1 stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8-inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8-inch from edges and ends of panels.

END OF SECTION 061600

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim.
 - 2. Wood cabinets.
 - 3. Closet and utility shelving.
 - 4. Shop finishing of interior woodwork.
- B. Related Sections include the following:
 - 1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 2. Division 12 for solid surface and quartz counter tops.

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.
- C. Samples for Verification:
 - 1. Lumber with or for transparent finish, not less than 50 mm, for each species and cut, finished on 1 side and 1 edge.
 - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.

3. Solid-surfacing materials, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

- A. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products Certified participant in AWI's Quality Certification Program.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 1. Provide AWI Quality Certification Program labels indicating that woodwork, including installation, complies with requirements of grades specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field

measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Certified Wood: Interior architectural woodwork shall be produced from wood obtained from forests certified by an FSC accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- C. Wood Species and Cut for Transparent Finish: White Oak, quarter sawn.
- D. Wood Products: Comply with the following:
 - 1. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.
- C. Bar Pulls: Back mounted, solid metal, 3-3/4 in. center to center screw mounting brushed nickel pull – Overall length 5-1/3 in.; basis of design: Richelieu "Contemporary Metal Pull #5632" or approved equal.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131].
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081
- F. Shelf Rests: BHMA A156.9, B04013; metal.
- G. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides. S ☐☐☐☐ C ☐☐☐☐ S ☐☐☐☐
- H. Door Locks: BHMA A156.11, E07121.
- I. Grommets for Cable Passage through Countertops: 2-☐☐☐☐ OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc.
 2. Or approved equal
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 1. Satin Brushed Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Adhesives shall not contain urea formaldehyde.
- D. VOC Limits for Installation Adhesives: Installation adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Wood Glues: 30 g/L.
 2. Multipurpose Construction Adhesives: 70 g/L.
 3. Contact Adhesive: 250 g/L.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide premium grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members **3/4 Inch** Thick or Less: **1/16 inch**.
 - 2. Edges of Rails and Similar Members More Than **3/4 Inch** Thick: **1/8 inch**.
 - 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: **1/16 inch**.
- D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.5 WOOD CABINETS FOR TRANSPARENT FINISH

- A. AWI Type of Cabinet Construction: Premium.
- B. Wood Species and Cut for Exposed Surfaces: Plyboo – Amber Edge Grain Plywood – BP V4896A
 - 1. Matching of Veneer Leaves: Book match.
 - 2. Vertical Matching of Veneer Leaves: End match.
- C. Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber, same species indicated for exposed surfaces.
 - 3. Drawer Bottoms: Hardwood plywood.
- D. Provide dust panels of **1/4-inch** plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.7 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. This Article generally applies to shop-assembled frames. Job-built work is standing trim.
- B. Quality Standard: Comply with AWI Section 900.

- C. Grade: Premium.
- D. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.
- E. Wood Species and Cut: Clear Birch, rift sawn.

2.8 CLOSET AND UTILITY SHELVING

- A. Shelf Material: 3/4-inch solid lumber
- B. Cleats: 3/4-inch solid lumber.

2.9 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- D. Transparent Finish:
 - 1. AWI Finish System: Catalyzed polyurethane.
 - 2. Color: Match Architect's sample to match the doors.
 - 3. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of **1/8 inch in 96 inches**.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than **1/8 inch in 96-inch** sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than **16 inches** o.c.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than **1/8 inch in 96-inch** sag, bow, or other variation from a straight line.
 - 3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- H. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

END OF SECTION 064023

SECTION 072100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board insulation.
 - 2. Mineral-wool blanket insulation.

- B. Related Requirements:

- 1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.
 - 2. Section 061600 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
 - 3. Section 071416 "Cold Fluid-Applied Waterproofing" for insulated drainage panels installed with plaza deck insulation.
 - 4. Section 072119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.

1.3 ACTION SUBMITTALS

- A. Product Data:

- 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Mineral-wool blanket insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

- 1. Sign, date, and post the certification in a conspicuous location on Project site.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type X: ASTM C578, Type X, 15-psi minimum compressive strength; unfaced.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. MBCI.
 - d. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGM Industries, Inc.
 - b. Gemco.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Demilec (USA) LLC.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- #### A.
- Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- #### A.
- Comply with insulation manufacturer's written instructions applicable to products and applications.
- #### B.
- Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- #### C.
- Install insulation with manufacturer's R-value label exposed after insulation is installed.
- #### D.
- Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- #### E.
- Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.
 - 3. Supplement adhesive attachment of insulation by securing boards with 2-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than 1 length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lbs./cu. ft.
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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: Water-drainage exterior insulation and finish system (EIFS).
 - 1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
 - 2. Water-resistive barrier coatings.
- B. Related Requirements: Section 072726 "Fluid-Applied Membrane Air Barriers" for fluid-applied, synthetic polymer air barriers applied over sheathing behind EIFS-clad wall assemblies.

1.3 DEFINITIONS

- A. Definitions in ASTM E2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory.
- B. Shop Drawings:
 - 1. Include details for EIFS buildouts.
 - 2. Include details for parapet cap flashing.
- C. Samples: For each exposed product and for each color and texture specified, 8 inches square in size.

- D. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
 - 1. Include similar Samples of exposed accessories involving color selection.
 - 2. Include exposed trim and accessory Samples to verify color selected.
 - 3. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
 - 1. EIFS complies with requirements.
 - 2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
 - 3. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive barrier coatings, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
- C. Product Certificates: For insulation and joint sealant, from manufacturer.
- D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For EIFS to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate the aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 1. Stack insulation board flat and off the ground.
 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.
 1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 degrees F for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
 2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
 - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.

- b. Insulation installed as part of EIFS.
 - c. Insulation adhesive and mechanical fasteners.
 - d. EIFS accessories, including trim components and flashing.
 - e. Water-resistive barrier coatings.
 - f. EIFS drainage components.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 1. Dryvit Systems, Inc.
 - 2. Master Wall Inc.
 - 3. Parex USA, Inc.
 - 4. Sto Corp.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:
- 1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
 - 2. Drainage Efficiency: 90 percent average minimum when tested in accordance with ASTM E2273.

2.3 EIFS MATERIALS

- A. Water-Resistive Barrier Coating: EIFS manufacturer's standard formulation and accessories for use as water-resistive barrier coating; compatible with substrate.
- 1. Water-Resistance: Comply with physical and performance criteria of ASTM E2570/E2570M.
- B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

- C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with the following:
 - 1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
- D. Molded (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
 - 1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, in accordance with ASTM E84.
 - 2. Dimensions: Provide insulation boards of not more than 24 by 48 inches, with thickness indicated on Drawings.
 - 3. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical-drainage channels, slots, or waves on the back side of board.
 - 4. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.
- E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. in accordance with ASTM E2098/E2098M and the following:
 - 1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
- F. Base Coat: EIFS manufacturer's standard mixture complying with 1 of the following:
 - 1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 - 2. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
- G. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- H. Finish Coat: EIFS manufacturer's standard acrylic-based coating complying with the following:
 - 1. Colors: Match Architect's sample.
 - 2. Textures: As selected by Architect from manufacturer's full range.
- I. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- J. Water: Potable.
- K. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and

complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

1. Casing Bead: Prefabricated, 1-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, 1-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Weep Screed/Track: Prefabricated, 1-piece type for attachment behind insulation with perforated face leg and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
4. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant 3/4-inch-minimum.
5. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
6. Parapet Cap Flashing: Type for both flashing and covering parapet top, with design complying with ASTM C1397.

2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Begin coating application only after surfaces are dry.
 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
 - 1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.3 EIFS INSTALLATION, GENERAL

- A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

- A. Water-Resistive Barrier Coating: Apply over sheathing to provide a water-resistive barrier.
 - 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
- B. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints,[at windowsills,] and elsewhere as indicated. Coordinate with installation of insulation.
 - 1. Weep Screed/Track: Use at bottom termination edges, at window and door heads of water-drainage EIFS unless otherwise indicated.
 - 2. Windowsill Flashing: Use at windows unless otherwise indicated.
 - 3. Expansion Joint: Use where indicated on Drawings.
 - 4. Casing Bead: Use at other locations.
 - 5. Parapet Cap Flashing: Use where indicated on Drawings.

3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C1397 and the following:
1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
 2. Apply adhesive to ridges on back of channeled insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.
 3. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
 4. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or applying base coat and reinforcing mesh.
 5. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
 6. Begin first course of insulation from a level base line and work upward.
 - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
 7. Apply channeled insulation, with drainage channels aligned vertically.
 8. Interlock ends at internal and external corners.
 9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16-inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
 10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
 11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than [1/32-inch] [1/16-inch] from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16-inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
 12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4-inch.
 13. Install foam buildouts and attach to structural substrate by adhesive.
 14. Interrupt insulation for expansion joints where indicated.
 15. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
 16. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.

17. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
 18. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 19. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.
- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
 2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 3. At floor lines in multilevel wood-framed construction.
 4. Where wall height or building shape changes.
 5. Where EIFS manufacturer requires joints in long continuous elevations.

3.7 BASE COAT APPLICATION

- A. Water-Resistant Base Coat: Apply full-thickness coverage to exposed insulation and to exposed surfaces of sloped shapes, window sills, parapets and to other surfaces indicated on Drawings.
- B. Base Coat: Apply full coverage to exposed insulation with not less than 1/16-inch dry-coat thickness.
- C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.

3.8 FINISH COAT APPLICATION

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Water-resistive barrier coatings applied over sheathing.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.10 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072419

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Vapor-retarding, fluid-applied air barriers.
- B. Related Requirements: Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04-cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested in accordance with ASTM E2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR RETARDING

- A. Medium-Build, Vapor-Retarding Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
 - a. Master Builders Solutions.
 - b. PROSOCO, Inc.
 - c. TK Products.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004-cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
 - b. Vapor Permeance: Maximum 5; ASTM E96/E96M.
 - c. Ultimate Elongation: Minimum 300 percent; ASTM D412, Die C.
 - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

- B. Primer: Liquid waterborne, solvent-borne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0187-inch thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. Pecora Corporation.
 - c. The Dow Chemical Company.
 - d. Tremco Incorporated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from 1 plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from 1 substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.

2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 1. Vapor-Retarding, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in 1 coat. Apply additional material as needed to achieve void- and pinhole-free surface.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. 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. Air-barrier dry film thickness.
 3. Continuous structural support of air-barrier system has been provided.
 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 5. Site conditions for application temperature and dryness of substrates have been maintained.
 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 7. Surfaces have been primed, if applicable.
 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 9. Termination mastic has been applied on cut edges.
 10. Strips and transition strips have been firmly adhered to substrate.
 11. Compatible materials have been used.
 12. Transitions at changes in direction and structural support at gaps have been provided.
 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 14. All penetrations have been sealed.
- C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- D. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Concealed-fastener, lap-seam metal wall panels.
- B. Related Requirements:
 - 1. Section 074213.16 "Metal Plate Wall Panels" for solid metal plate wall panels.
 - 2. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review of procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
 - 1. Concealed-fastener, lap-seam metal wall panels.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

1. Include Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For concealed-fastener, lap-seam metal wall panels, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal panel assembly, including corner, soffits, supports, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.

- b. Deterioration of metals and other materials beyond normal weathering.
- 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

- B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Berridge Manufacturing Company.
 - b. CENTRIA, a Nucor Brand.
 - c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - 2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.040-inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Two-coat fluoropolymer.
 - d. Color: As selected by Architect from manufacturer's full range.
- C. Reveal-Joint, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and a flat pan between panel edges; with narrow reveal joint between panels.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Berridge Manufacturing Company.
 - b. CENTRIA, a Nucor Brand.
 - c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - 2. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.040-inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: Two-coat fluoropolymer.
 - d. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets,

fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch wide and 1/8-inch thick.
 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. 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. Aluminum Panels and Accessories:
1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a 4-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets 1 full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

SECTION 074213.16 - METAL PLATE WALL PANELS

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 metal plate wall panels.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
 1. Build mockup of typical metal panel assembly, including 48-inch by 60-inch supports, attachments, and accessories.
 2. Water-Spray Test: Conduct water-spray test of mockup of metal panel assembly, testing for water penetration according to AAMA 501.2.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 2. Warranty Period: 2 years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair, finish, or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06-cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 METAL PLATE WALL PANELS

- A. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Dri-Design painted aluminum panels, or comparable product by 1 of the following:
 - a. Alply Insulated Panels LLC.
 - b. Americlاد, LLC.
 - c. Centria; Intercept.
 - d. Protean Construction Products, Inc.
- B. Panel Depth: 1-1/4 inch, nominal.
- C. Aluminum Sheet: Tension-leveled, smooth aluminum sheet, ASTM B209, 0.120-inch thick.
 1. Exterior Finish: 2-coat fluoropolymer.
 - a. Color: As selected by Architect from manufacturer's full range.
- D. Attachment Assembly: Manufacturer's standard.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer. Provide sealant types that are compatible with panel materials, are nonstaining, and do not damage panel finish.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. 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. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a 4-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal plate wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
 2. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4-inch in 20 feet, non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.16

SECTION 074293 - SOFFIT PANELS

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: Metal soffit panels.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar samples of trim and accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below:
 - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06-cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft.

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

- 1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 METAL SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

- B. Metal Soffit Panels: Match profile and material of metal fascia panels.

- 1. Finish: Match finish and color of metal fascia.
 - 2. Sealant: Factory applied within interlocking joint.

- C. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. AEP Span a brand of ASC Profiles LLC, a part of BlueScope.
 - b. Architectural Building Components.
 - c. ATAS International, Inc.
 - d. Berridge Manufacturing Company.
 - e. CENTRIA, a Nucor Brand.
 - f. Dimensional Metals, Inc.
 - g. Drexel Metals.
 - h. Englert, Inc.
 - i. Fabral; a brand of OmniMax International.
 - j. Firestone Building Products.
 - k. Innovative Metals Company, Inc.
 - l. MBCI; Cornerstone Building Brands.
 - m. McElroy Metal, Inc.
 - n. Merchant & Evans Inc.
 - o. Metal Sales Manufacturing Corporation.
 - p. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
 - q. Ultra Seam, Inc.

- 2. Material: Same material, finish, and color as metal fascia panels.

3. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 0.028-inch.
 - b. Exterior Finish: 2-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range.
4. Aluminum Sheet: Coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: 0.040-inch.
 - b. Surface: Smooth, flat finish.
 - c. Exterior Finish: 2-coat fluoropolymer.
 - d. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch wide and 1/8-inch thick.

2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. 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. Steel Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5-mil.
- D. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010-mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 - 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required and as indicated by the Drawings.

3.3 INSTALLATION

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a 4-panel lap splice condition.
 - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
 - 2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.

3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074293

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories and cover board.
5. Walkways.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- ##### A. Roofing Terminology:
- Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

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

1. Meet with Owner, Architect, Contractor, Owner's insurer if applicable, roofing installer, roofing system manufacturer's representative, deck installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane termination details.
 3. Flashing details at penetrations.
 4. Tapered insulation layout, thickness, and slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened locations, if any.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with adjoining air barrier.
- C. Samples for Verification: For the following products:
 1. Roof membrane and flashings, of color required.
 2. Walkway pads or rolls, of color required.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installer and manufacturer.
- B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturers: A qualified manufacturer that is listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
 2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, and cover boards, for the following warranty period:
 - 1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
 - 1. Accelerated Weathering: Roof to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to 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.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): 120 lbf/sq. ft.
 - 2. Zone 2 (Roof Area Perimeter): 165 lbf/sq. ft.

- a. Location: From roof edge to 16 feet inside roof edge.
 - 3. Zone 3 (Roof Area Corners): 210 lbf/sq. ft.
 - a. Location: 6 feet in each direction from each building corner.
 - D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: Class 1A-120.
 - 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 VSH.
 - E. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested in accordance with ANSI/CRRC S100.
 - F. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- 2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
- A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced TPO sheet.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Carlisle Syntec Systems.
 - b. Cooley Group.
 - c. Custom Seal Inc.
 - d. Firestone Building Products.
 - e. Flex Membrane International Corp.
 - f. GAF.
 - g. GenFlex Roofing Systems.
 - h. Johns Manville; a Berkshire Hathaway company.
 - i. Mule-Hide Products Co., Inc.
 - j. Versico Roofing Systems; Carlisle Construction Materials.
 - 2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
 - 3. Thickness: 80 mils, nominal.
 - 4. Exposed Face Color: Tan color matching adjoining pre-finished fascia.

2.3 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55-mils thick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch diameter.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Slip Sheet: Manufacturer's standard, of thickness required for application.
- G. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1- by 1/8-inch thick; with anchors.
- H. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, 1.45-lb/cu. ft. minimum density, 25 psi minimum compressive strength, square edged.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. DiversiFoam Products.
 - b. Kingspan Insulation LLC.
 - c. Owens Corning.
 - d. The Dow Chemical Company.

2. Thermal Resistance: R-value of 5.0 per 1 inch.
3. Size: 48 by 48 inches.
4. Thickness:
 - a. Base Layer: 1-1/2 inches.
 - b. Upper Layer: 4-1/2 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4-inch.
3. Slope:
 - a. Roof Field: 1/4-inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2-inch per foot unless otherwise indicated on Drawings.

2.5 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Full-spread, spray-applied, low-rise, 2-component urethane adhesive.
- D. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 1. Thickness: 1/2-inch.
- E. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
 1. Thickness: 1/2-inch.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16-inch thick and acceptable to roofing system manufacturer.
 1. Size: Manufacturer's standard size.
 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
 - 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 - 1. Install base layer of insulation with joints staggered not less than 24 inches.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4-inch in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4-inch with insulation.
 - f. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.
 - g. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 - 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4-inch in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4-inch with insulation.
 - f. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.

- g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.5 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 INSTALLATION OF WALKWAYS

- A. Flexible Walkways:
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - e. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide 6-inch clearance between adjoining pads.

3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.10 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 1. Owner: <Insert name of Owner>.
 2. Owner Address: <Insert address>.
 3. Building Name/Type: <Insert information>.
 4. Building Address: <Insert address>.
 5. Area of Work: <Insert information>.
 6. Acceptance Date: _____.
 7. Warranty Period: <Insert time>.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph>;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof-drainage sheet metal fabrications.
2. Low-slope roof sheet metal fabrications.
3. Wall sheet metal fabrications.
4. Miscellaneous sheet metal fabrications.

1.2 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Roof-drainage sheet metal fabrications.
2. Low-slope roof sheet metal fabrications.
3. Wall sheet metal fabrications.
4. Miscellaneous sheet metal fabrications.

B. Product Data Submittals:

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

C. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

D. Samples for Verification: For each type of exposed finish.

E. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.
 1. Surface: Smooth, flat.
 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 3. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ATAS International, Inc.
 - b. Carlisle WIP Products; a brand of Carlisle Construction Materials.
 - c. GCP Applied Technologies Inc.
 - d. Henry Company.
 - e. Owens Corning.
 - f. Polyglass U.S.A., Inc.
 - g. Protecto Wrap Company.
 - 2. Source Limitations: Obtain underlayment from single source from single manufacturer.
 - 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 degrees F or lower.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - 2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
 - 3. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch wide and 1/8-inch thick.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4-inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Fabricate from the following materials:

- a. Galvanized Steel: 0.022-inch thick.

- B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:

1. Galvanized Steel: 0.028-inch thick.

- C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes. Fabricate from the following materials:

1. Galvanized Steel: 0.028-inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight.

1. Fabricate from the following materials:

- a. Galvanized Steel: 0.040-inch thick.

- B. Base Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028-inch thick.

- C. Counterflashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022-inch thick.

- D. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028-inch thick.

2.8 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:

1. Zinc: 0.032-inch thick.

- B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022-inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least 2 fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 degrees F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.

- 1) Do not install sealant-type joints at temperatures below 40 degrees F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Downspouts:
 1. Join sections with 1-1/2-inch telescoping joints.
 2. Provide hangers with fasteners designed to hold downspouts securely to walls.
 3. Locate hangers at top and bottom and at approximately 60 inches o.c.
 4. Provide elbows at base of downspout to direct water away from building.
 5. Connect downspouts to underground drainage system.
- C. Parapet Scuppers:
 1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
 3. Loosely lock front edge of scupper with conductor head.
 4. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.
- E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.
- C. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry."

3.7 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
 - 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 - 2. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
 - 1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 - 2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4-inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.10 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Roof hatches.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
 - 2. Section 061000 "Rough Carpentry" for sleepers and blocking as required to elevate roof hatch.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
 - 4. Section 230548 "Vibration and Seismic Controls for HVAC" for special curbs designed to accommodate seismic and vibration controls.
 - 5. Section 233423 "HVAC Power Ventilators" for power roof-mounted ventilators.
 - 6. Section 237413 "Packaged, Outdoor, Central-Station Air-Handling Units" for standard curbs specified with rooftop units.

1.2 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane, base flashing, interfacing, and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

- C. Samples: For each exposed product and for each color and texture specified, prepared on samples of size to adequately show color.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ACUDOR Products, Inc., or similar product from manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ACUDOR Products, Inc.
 - b. AES Industries, Inc.
 - c. Architectural Specialties, Inc.
 - d. BILCO Company (The).
 - e. Babcock-Davis.
 - f. Custom Solution Roof and Metal Products, a division of Colony Heating.
 - g. Dur-Red Products.
 - h. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
 - i. KCC Manufacturing.
 - j. Kingspan Light + Air LLC.
 - k. Lexcor; a division of Luxsoco corp.
 - l. Metallic Products Corporation.
 - m. Milcor; Hart & Cooley, Inc.
 - n. Nystrom, Inc.
 - o. O'Keeffe's Inc.
 - p. Pate Company (The).
 - q. Precision Ladders, LLC.
 - r. Williams Bros. Corporation of America (The).
- B. Type and Size: Single-leaf lid, 30 by 36 inches opening clearance.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material, Aluminum:
 - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - 2. Finish: 2-coat fluoropolymer.
 - 3. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
 - 1. Insulation: 2-inch-thick, polyisocyanurate board.
 - a. R-Value: 12.0 according to ASTM C1363.
 - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
 6. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Coordinate equipment hatch with membrane roof installer/supplier for water diverter or cricket on side that obstructs water flow.
- F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
 2. Height: 42 inches above finished roof deck.
 3. Material: Steel tube.
 4. Post: 1-5/8-inch-diameter pipe.
 5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPAC2; not less than 1-1/2 inches thick.
- D. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

- F. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach ladder-assist post according to manufacturer's written instructions.

D. Seal joints with elastomeric sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Joint sealants.
2. Joint sealant backing materials.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint Sealant Schedule: Include the following information:

1. Joint sealant application, joint location, and designation.
2. Joint sealant manufacturer and product name.
3. Joint sealant formulation.
4. Joint sealant color.

1.3 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

- B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.5 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degrees F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
- B. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- B. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
- C. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.

2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.8 JOINT SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
 - 4. Provide flush joint profile at locations indicated on Drawings in accordance with Figure 8B in ASTM C1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

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Lee's Summit, Missouri

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

- B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
6. Division 28 Section "Access Control Hardware".

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).
 - 3. Steelcraft (ST).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, and ANSI/SDI A250.4 for physical performance level.
 - 1. Design: Flush panel.

2. Core Construction: Foamed in place polyurethane and steel reinforced core with no stiffener face welds.
 - a. Provide 18 gauge steel vertical reinforcements 6 inches apart and welded in place. Foamed in place polyurethane core is chemically bonded to all interior surfaces. No face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.374 and R-Value 2.53, including insulated door, Mercury thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.378 and R-Value 2.5, including insulated door, kerf type frame, and threshold.
 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.

- a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Manufacturers Basis of Design:
1. Curries Company (CU) - Polystyrene Core - 707 Series.
 2. Curries Company (CU) - Energy Efficient - 797 Mercury Series.

2.4 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – Thermal Break TQ Series.
 - b. Or approved equal.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
 - b. Or approved equal.
- D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

- E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate,

frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld joints continuously through full throat width of frames, including rabbets, soffits, and stops; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. Equal Rabbet Frames: Provide frames with equal rabbet dimensions unless glazing and removable stops require wider dimensions on glass side of frame.
5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
6. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
8. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

9. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
10. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
 - a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.
 - c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".
 - d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
11. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
12. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
13. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
14. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance

with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 - 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.

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Lee's Summit, Missouri

- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 062023 "Interior Finish Carpentry " for wood door frames including fire-rated wood door frames.
2. Section 064216 "Flush Wood Paneling" for requirements for veneers from the same flitches for both flush wood doors and flush wood paneling.
3. Section 083473.16 "Wood Sound Control Door Assemblies" for acoustic flush wood doors.
4. Section 088000 "Glazing" for glass view panels in flush wood doors.
5. Section 099300 "Staining and Transparent Finishing" for field finishing doors.
6. Section 134900 "Radiation Protection" for lead-lined flush wood doors.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Dimensions and locations of blocking.
 2. Dimensions and locations of mortises and holes for hardware.
 3. Dimensions and locations of cutouts.
 4. Undercuts.
 5. Requirements for veneer matching.
 6. Doors to be factory finished and finish requirements.
 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body and is a certified participant in AWI's Quality Certification Program.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and

maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

- B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 43 and 70 percent during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Exterior Doors: Five years from date of Substantial Completion.
 - 4. Warranty Period for Solid-Core Interior Doors: Life of installation.
 - 5. Warranty Period for Hollow-Core Interior Doors: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Algoma Hardwoods, Inc.
 - 2. Marshfield Door Systems, Inc.
 - 3. Eagle Plywood & Door Manufacturing, Inc.
 - 4. Mohawk Flush Doors, Inc.; a Masonite company.
 - 5. Graham Wood Doors
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
- B. Regional Materials: Flush wood doors shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- C. Certified Wood: Flush wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- D. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- E. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 6. Pairs: Provide formed-steel edges and astragals with intumescent seals.
 - a. Finish steel edges and astragals with baked enamel same color as doors.
 - b. Finish steel edges and astragals to match door hardware (locksets or exit devices).
- F. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- G. Structural-Composite-Lumber-Core Doors:
 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf (3100 N).
 - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

H. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware, as follows:
 - a. 5-inch (125-mm) top-rail blocking.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
 - d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species: Birch.
3. Stain Color: Clear CL18 by VT Industries
4. Cut: Rotary Cut.
5. Match between Veneer Leaves: Book match.
6. Assembly of Veneer Leaves on Door Faces: Center-balance match.
7. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
8. Transom Match: Continuous match.
9. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
10. Exposed Vertical and Top Edges: Applied wood-veneer edges of same species as faces and covering edges of faces - edge Type B.
11. Core: Structural composite lumber.
12. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with NFPA 80 requirements for fire-rated doors.

- B. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - 1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Louvers: Factory install louvers in prepared openings.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Use only paints and coatings that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards",,, System 11, catalyzed polyurethane,.
 - 3. Staining: Clear CL18 by VT Industries
 - 4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.

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

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 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. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Detail fabrication and installation of access doors and frames for each type of substrate.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling coordination drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, feilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Babcock-Davis.
 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 3. Larsen's Manufacturing Company.
 4. Milcor Inc.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling.
 3. Uncoated Steel Sheet for Door: Nominal 0.060 inch , 16 gage.
 - a. Finish: Factory finish.
 4. Frame Material: Same material and thickness as door.
 5. Hinges: Spring-loaded, concealed pin type.
 6. Hardware: Latch.
- D. Fire-Rated, Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.
 4. Temperature-Rise Rating: 250 deg F at the end of 30 minutes.
 5. Uncoated Steel Sheet for Door: Nominal 0.036 inch , 20 gage.
 - a. Finish: Factory finish.
 6. Frame Material: Same material, thickness, and finish as door.
 7. Hinges: Concealed pin type.
 8. Hardware: Latch.

E. Hardware:

1. Latch: Self-latching bolt operated by flush key with interior release.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder locks, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 - 2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- C. Size opening for type of access being provided.
- D. Insure access is provided to all features as required.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.
- C. Clean doors and hardware after installation.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Insulated service doors.
- B. Related Requirements: Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats, including full vision window secured to slat.
 - 2. Bottom bar with sensor edge.
 - 3. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing and inspecting agency.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.
- C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.
- C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than 2 hours' normal travel time from Installer's place of business to Project site.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design."
- B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - 2. Testing: According to ASTM E330/E330M or DASMA 108 for garage doors and complying with acceptance criteria of DASMA 108.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20-lbf/sq. ft. wind load, acting inward and outward.
- C. Windborne-Debris Impact Resistance: Provide glazed and impact-protective overhead coiling doors that pass ASTM E1886 missile-impact and cyclic-pressure tests according to ASTM E1996 for Wind Zone 4 or DASMA 115 for enhanced protection.
 - 1. Large-Missile Test: For overhead coiling doors located within 30 feet of grade.
- D. Seismic Performance: Overhead coiling doors are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.3 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ACME Rolling Doors.
 - b. Hormann High Performance Doors.
 - c. Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 750,000 cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
 - 1. Include tamperproof cycle counter.

- C. Air Infiltration: Maximum rate of 0.4-cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283 or DASMA 105.
- D. Insulated Door Curtain R-Value: 4.5 degrees F x h x sq. ft./Btu.
- E. Insulated Door Assembly U-Factor: 0.90 Btu/degrees F x h x sq. ft.
- F. Door Curtain Material: Galvanized steel.
- G. Door Curtain Slats: Flat profile slats of 10-inch center-to-center height.
 - 1. Vision Panels: Approximately 10- by 1-5/8-inch openings spaced approximately 2 inches apart and beginning 12 inches from end guides; in 3 rows of slats at height indicated on Drawings; installed with insulated vision-panel glazing.
 - 2. Insulated-Slat Interior Facing: Metal.
 - 3. Gasket Seal: Manufacturer's standard continuous gaskets between slats.
- H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8-inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- I. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- J. Hood: Match curtain material and finish.
 - 1. Shape: Square.
 - 2. Mounting: Face of wall.
- K. Locking Devices: Equip door with chain lock keeper.
- L. Manual Door Operator: Chain-hoist operator.
- M. Electric Door Operator:
 - 1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 100 cycles per day.
 - 2. Operator Location: As indicated on Drawings.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
 - 4. Motor Exposure: Exterior, wet, and humid
 - 5. Motor Electrical Characteristics:
 - a. Horsepower: 3 hp or as indicated on Electrical Drawings sufficient to accomplish performance requirements.
 - b. Voltage: 208 V ac, single phase, 60 Hz or as indicated on Electrical Drawings sufficient to accomplish performance requirements.
 - 6. Emergency Manual Operation: Chain type.

7. Obstruction-Detection Device: Automatic photoelectric sensor, electric sensor edge on bottom bar, pneumatic sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
8. Control Station(s): Where indicated on Drawings.
9. Other Equipment: Audible and visual signals, portable radio-control system.

N. Curtain Accessories: Equip door with weather seals.

O. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028-inch; and as required.
 2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
 3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
 4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010-inch and minimum aluminum thickness of 0.032-inch.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding wind locks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: As specified in Section 087100 "Door Hardware," standard with manufacturer, and keyed to building keying system.
- B. Chain Lock Keeper: Suitable for padlock.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weather Seals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.

2.9 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03-in./ft. of span under full load.

- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic-closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.11 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
 2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
1. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.
- L. Portable Radio-Control System: Consisting of 2 of the following per door operator:
 - 1. Three-channel universal coaxial receiver to open, close, and stop door.
 - 2. Portable control device to open and stop door may be momentary-contact type; control to close door shall be sustained- or constant-pressure type.
 - 3. Remote-antenna mounting kit.

2.12 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 ALUMINUM FINISHES

- A. Mill Finish: Manufacturer's standard.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.14 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 1. Perform maintenance, including emergency callback service, during normal working hours.
 2. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 083500 - FOUR-FOLD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes 4-fold metal doors with surface-mounted tube frames.
- B. Operation of 4-fold metal doors includes overhead-mounted electro-mechanical operators.

1.3 ACTION SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product data for each type of product specified consisting of manufacturer's technical product data and installation instructions for each type of door required, including data substantiating that products comply with requirements.
- C. Submittal Drawings showing fabrication and installation of 4-fold metal doors including plans, elevations, sections, details of components, hardware, operating mechanism, and attachments to the other units of Work. Include wiring diagrams for coordination with electrical trade.
- D. Reference list including 5 successful installations of this type of door within the past 2 years.

1.4 QUALITY ASSURANCE

- A. Doors shall be designed to withstand external or internal horizontal wind loads of 20 pounds minimum per square foot. The maximum allowable deflection shall not exceed 1/120 of the span. Fiber stresses in main members shall be limited to 27,000 pounds per square inch. Steel frames shall be designed in accordance with the AISC "Steel Construction Manual."
- B. Door manufacturer shall have at least 10 years' experience in manufacturing door type specified for emergency vehicle applications.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store delivered materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling.
- B. Handle materials carefully to prevent damage.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: 5 years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Model FF300 Series/Glazed, 4-fold industrial metal doors manufactured by Door Engineering and Manufacturing or approved equal from the following manufacturers (no substitutions):
 - 1. Electric Power Door.
 - 2. Overhead Door Company.

2.2 MATERIALS

- A. Steel Tube: ASTM A513 and ASTM A500/A500M.
- B. Steel Sheets: Steel sheets of commercial quality, complying with ASTM A1011/A1011M hot-rolled steel sheet.

- C. Hardware: Manufacturer's standard components.
- D. Fasteners: Zinc-coated steel.

2.3 FOUR-FOLD DOORS

- A. Construction: Door framing shall be minimum 14-gauge structural-steel tube with 14-gauge steel sheet on the exterior and interior faces. Sheeting shall be formed on the vertical edges with no visible welds on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line, in the vertical or horizontal plane of the door opening by more than 1/8-inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
- B. Surface-Mounted Tube Frame: Supply pre-hung tube frame system constructed of minimum TS6x4x0.25, designed to anchor to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.
- C. Factory Finish: Door panels and tube frames shall be finished with manufacturer's standard PPG Spectracron epoxy primer and polyurethane top coat.
 - 1. Interior and Exterior Color: Custom color to match Architect's sample.
 - 2. Operator and operating hardware shall be powder-coated manufacturer's standard gray.
- D. Hardware: Hardware shall include guide tracks and brackets, trolleys, center guides, not less than 3 pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc., necessary for complete installation and operation.
- E. Hinges: Jamb hinges shall be dual shear and have 2 thrust bearings and 2 needle bearings. Fold hinges shall be stainless steel and be dual shear with 2 thrust bearings. All bearings shall be completely concealed within the hinge barrel and include grease zerks. All hinge pins shall be minimum 3/4-inch-diameter hardened steel.
- F. Weather Stripping: Material shall be adjustable and readily replaceable and provide a substantially weather-tight installation. Weather stripping at center shall be 1/16-inch cloth inserted neoprene and include no exposed fasteners on the exterior face of the panel. Weather stripping at sill shall include two 1/16-inch cloth inserted neoprene sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.
- G. Perimeter Weather Stripping: Provide jamb and head weather stripping of 1/16-inch cloth-inserted neoprene bulb (or closed-cell neoprene).
- H. Vision Panels: Provide 1-inch insulated vision panels (PPG Solarban 60) of the size, shape and location as noted on the Drawings.

2.4 OPERATOR

- A. Each 4-fold door shall be operated by an overhead-mounted electro-mechanical drive unit designed for high cycle operation. Operator consists of an electric motor, gear reducer, and rotating drive arm. The door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil-impregnated bronze bearings on polished shafts.
- B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to freewheeling mode for manual operation.
- C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for 3-phase, 208/230/480 VAC, 60 Hertz operation.
- D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards. Incoming electrical shall be 208VAC single phase.
 - 1. Controls shall include a programmable logic controller with digital message display or LED indicators. Controller shall include programmable close timers and programmable inputs/outputs.
 - 2. Motor starters shall be magnetic reversing, factory wired with overload and under-voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in 1 enclosure with a wiring diagram placed on the inside of the cover.
 - 3. If incoming voltage is single phase, control panel shall include a variable-frequency drive to convert voltage to 3-phase for the motor.
 - 4. Enclosures shall be NEMA 4 with disconnect switch.
 - 5. Push buttons (interior) for each door shall have 1 momentary pressure 3-button push button station marked "OPEN," "CLOSE," and "STOP." Push button enclosure shall be NEMA 4. Push buttons location shall be coordinated with Architect prior to installation.
 - 6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
 - 7. Safety Edges: Provide electric safety edges on leading edge of all doors to reverse door upon contact with obstruction.
 - 8. Photo Eyes: Provide 1 exterior, jamb-mounted, through-beam-type photo eyes, NEMA 4 rated.
 - 9. Interior Presence Sensor: Provide manufacturer's standard interior presence sensor to ensure doors do not close before the apparatus is far enough into the apparatus bays to not be damaged by the closing door.
 - 10. Radio Controls: Provide 1 radio receiver and 3 single-button remotes per door. Remotes to open and close doors with single button.
 - 11. Loop Detectors: Provide "pulse on exit type" loop detector to activate auto close timer once loop has been activated and cleared, include hand/auto switch to deactivate timer.

General Contractor shall coordinate installation of preformed loop with Installer prior to exterior apron being poured.

12. Wiring: Door manufacturer shall supply controls and components only. Electrical Contractor shall install controls and furnish and install conduits and wiring for jobsite power and control wiring.

2.5 SEQUENCE OF OPERATIONS

- A. Provide all equipment and accessories necessary for the following sequence of operations. All options listed must be provided.
- B. Opening the Door:
 1. Option 1: Pull cord at driver's side door which activates the timer. Once the timer expires, the doors automatically close after the specified amount of time.
 2. Option 2: Press the "Open" button on the flush-mount door-control station at the nearest pole entrance to the bays (1 each side of bay) or at each bay door. Once the button is pressed, the door will stay open until the "Close" button is pressed.
 3. Option 3: Press the remote transmitter from within the cab of the apparatus (3 remote transmitters will be provided for each door).
- C. Closing the Door:
 1. Option 1: Press the "Close" button on the flush-mount door-control station at the nearest ramp.
 2. Option 2: As the truck pulls in through the opening, it will pass through the exterior photo eyes and interior presence sensor which will reset the timer to close once they are cleared and the door will time out and close.
 3. Option 3: Press the remote transmitter from within the cab of the apparatus.
 4. Option 4: Utilize loop detection for activation of auto-close timer.
- D. Stopping the Door from Closing:
 1. Option 1: If the door is in the process of closing and an object is detected by the photo eye sensor or interior presence sensor, the door will stop and reverse to the open position.
 2. Option 2: If the door is in the process of closing and an object is detected by the pressure sensing edge, the door will stop and reverse to the open position.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install 4-fold metal doors in strict accordance with the approved drawings by qualified door erection crews. All door openings shall be completely prepared by the General Contractor prior to the installation of the doors. Permanent or temporary electric wiring shall be brought to the

door opening before installation is started and shall be completed so as not to delay the inspection test.

- B. Doors shall be set plumb, level, and square, and with all parts properly fastened and mounted. All moving parts shall be tested and adjusted and left in good operating condition.

3.2 ADJUSTING AND CLEANING

- A. Inspection of the doors and a complete operating test will be made by the Installer in the presence of the General Contractor or Architect as soon as the erection is complete. Any defects noted shall be corrected. After door approval in the above test, the General Contractor must assume the responsibility for any damage or rough handling of the doors during construction until the building is turned over to the Owner and final inspection is made.
- B. Clean surfaces and repaint abraded or damaged finished surfaces to match factory-applied finish.

END OF SECTION 083500

SECTION 083613 - SECTIONAL DOORS

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: Sectional-door assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:
 - 1. Glazing.
 - 2. Metal for door sections.
 - 3. Hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.
- C. Finish warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design" applicable to sectional doors.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: 5 years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - 2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
 - 4. Operability under Wind Load: Design sectional doors to remain operable under uniform pressure (velocity pressure) of 30 lbf/sq. ft. wind load, acting inward and outward.
- C. Windborne-Debris Impact Resistance: Provide sectional doors complying with the following requirements:
 - 1. Glazed Openings: Pass ASTM E1886 Large Missile Test and cyclic-pressure tests in accordance with ASTM E1996 for enhanced protection and Wind Zone applicable to basic design wind speed indicated on Drawings.
 - 2. Garage-Door Glazed Openings: Pass DASMA 115.
- D. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Hörmann LLC.
 - b. Overhead Door Corporation.
 - c. Raynor.
- B. Operation Cycles: Door components and operators capable of operating for not less than 100,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Air Infiltration: Maximum rate of 0.4-cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.
- D. U-Value: 0.052 Btu/sq. ft. x h x degrees F.
- E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G90 zinc coating.
 - 1. Door-Section Thickness: 2 inches.
 - 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: 0.022-inch nominal coated thickness.
 - 2) Surface: Manufacturer's standard, stucco embossed.
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.022-inch recommended in writing by manufacturer to comply with performance requirements.

3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch nominal coated thickness and welded to door section.
 4. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.040-inch-thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
 5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weather seal).
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
 6. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard insulation of type indicated below:
 - a. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
 - b. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- F. Aluminum Sections: ASTM B221 extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; in minimum thickness required to comply with requirements; with rail and stile dimensions and profiles indicated on Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.
1. Door-Section Thickness: 2 inches.
 2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
 - a. Hardware Locations: Provide reinforcement for hardware attachment.
 3. Insulated Stiles and Rails: Fill stiles and rails manufacturer's standard polyurethane expanding foam.
 4. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:
 - a. Insulating Glass Units: Manufacturers' standard unit with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.
- G. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
 - a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- H. Weather Seals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom, top, and jambs of door. Provide combination bottom weather seal and sensor edge for bottom seal.
- I. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
1. Insulating Glass Units: Manufacturer's standard.
- J. Exhaust Port: Manufacturer's standard, installed in bottom section in location indicated on Drawings.
- K. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - b. Provide double-end hinges where required for doors more than 16 feet wide unless otherwise recommended by door manufacturer in writing.
 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Case-hardened steel.
- L. Locking Device:
1. Chain Lock Keeper: Suitable for padlock.

2. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

M. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide 1 additional midpoint bracket for shafts up to 16 feet long and 2 additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended in writing by door manufacturer.
3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 5 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

N. Manual Door Operator:

1. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

O. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 100 cycles per day.
5. Operator Type: Manufacturer's standard for door requirements.
6. Motor: Reversible-type with controller (disconnect switch) for exterior, dusty, wet, or humid motor exposure. Use adjustable motor-mounting bases for belt-driven operators.

- a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 - 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Photoelectric sensor, electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 - b. Unmonitored Entrapment Protection: Pneumatic sensor edge, black, located within weather seal mounted to bottom bar.
 - 9. Control Station: Surface-mounted, 3-position (open, close, and stop) control.
 - a. Operation: Push button interior and key exterior.
 - b. Exterior-Mounted Unit: Full-guarded, surface-mounted, standard-duty, weatherproof type, NEMA ICS 6, Type 4 enclosure.
 - c. Features: Provide the following:
 - 1) Vehicle detection operation.
 - 2) Radio-control operation.
 - 3) Card-reader control.
 - 4) Photocell operation.
 - 5) Door-timer operation.
 - 6) Audible and visual signals that comply with regulatory requirements for accessibility.
 - 10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf.
 - 11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 - 12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- P. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- 1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

- a. Aluminum Finish: Comply with AAMA 2604 requirements for pigmented organic coatings applied to aluminum extrusions and panels.
 - b. Color and Gloss: As selected by Architect from manufacturer's full range.
2. High-Performance, Organic, Aluminum Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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. Storefront framing for punched openings.
 - 2. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Materials and Resources: Provide product information and certification letter indicating percentages by weight of post consumer and pre consumer recycled content for products having recycled content.
 - 3. Optimize Energy Performance: Provide information confirming that products contribute to increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.
- B. Shop Drawings: For aluminum-framed entrances, storefronts, and sunshades. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.

- e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers and seals.
 - 4. Coordinate construction with electrical systems and hardware.
 - C. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
 - D. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer in the state of Missouri responsible for their preparation.
 - E. Structural Performance:
 - 1. Combined load on sunshade configurations to be determined in accordance with ASCE 7 or applicable code requirements. Combined load consists of wind, snow and ice loads.
 - 2. Design sunshade configurations to withstand stresses due to combined load.
 - 3. Stresses resulting from thermal expansion/contraction, shall not cause permanent deformation of sunshade assemblies or disengagement from the glazed system.
 - 4. Blade deflection shall not exceed $L/120$ of span length.
 - 5. Submit test reports verifying compliance with each test requirement required by the project.
 - F. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
 - 1. Temperature Change (Range): 120 deg F (49 deg C), ambient; 180 deg F (82 deg C), material surfaces.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer and field testing agency.
 - B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

- C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors with 5 minimum years of experience who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. 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.
- D. Product shall comply with all applicable provisions of the current ADA Standards.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Air penetration through fixed glazing and framing areas.
 - f. Failure of operating components.
 - 2. Warranty Period: Ten years from date of Substantial Completion.

- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

- a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 - b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
 1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
 3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 70 as determined according to NFRC 500.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall and storefront system manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6, 6105-T5, or 6061-T6 alloy and temper.
- B. Thermal Barrier: When applied on a thermally broken captured system, sunshade shall be thermally isolated from the interior aluminum mullions by a nominal 0.25" thick low conductance material.
- C. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.
- D. Sealant: For sealants required within fabricated sunshade system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
- E. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall and storefront members members are nominal and in compliance with AA Aluminum Standards and Data.
- F. Fasteners and accessories: Nonmagnetic stainless steel to be non-corrosive and compatible with aluminum members, anchors, and other components.
- G. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- H. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- I. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle sunshade materials and components to avoid damage. Protect sunshade materials against damage from elements, construction activities, and other hazards before, during and after installation.
- J. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.3 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 451T Trifab System storefront or approved equal systems from one of the following:
 1. EFCO Corporation.
 2. Kawneer North America.

3. YKK AP America Inc.

- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels, sun control, entrances, and accessories, from single manufacturer.

2.4 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front.
 4. Finish: Selected by Architect from manufacturer's full range of finishes.
 5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.

2.5 INSULATED SPANDREL PANELS

- A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
1. Overall Panel Thickness: 2 Inch.
 2. Exterior Skin: Aluminum.

- a. Thickness: Manufacturer's standard for finish and texture indicated .
 - b. Finish: Match framing system .
 - c. Texture: Smooth .
 - d. Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene .
3. Interior Skin: Aluminum.
 - a. Thickness: Manufacturer's standard for finish and texture indicated .
 - b. Finish: Matching storefront framing .
 - c. Texture: Smooth .
 - d. Backing Sheet: 0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene .
4. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board .

2.6 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Provide Heavy Duty Stiles with 10" bottom rails. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 2. Door Design: Wide stile; 5-inch nominal width.
 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.7 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products and products complying with BHMA standard referenced.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

2.8 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

2.9 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.10 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. Selected from the full range of manufacturer's finishes.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with manufacturer's written instructions. Refer to installation instructions of the compatible curtain wall or storefront system.

- B. Please note that the installation instructions can differ from one compatible system to another one.
- C. Do not install damaged components.
- D. Fit joints to produce hairline joints free of burrs and distortion.
- E. Rigidly secure non-movement joints.
- F. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- G. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- H. Seal joints watertight where shown on approved shop drawings and/or manufacturer's standard installation instructions.
- I. Metal Protection:
 - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
 - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- J. Install components plumb and true in alignment with established lines and grades.
- K. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.2 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.4 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.
7. Insure system weep holes are clear and free of sealant and/ or other contaminants.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.5 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 16 feet; 1/4 inch over total length.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections. Provide tests in presence of Owners representative.
- D. Prepare test and inspection reports.

3.7 ADJUSTING, CLEANING AND PROTECTION

- A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum sunshade system from damage from grinding and polishing compounds, plaster, lime, cement, acid and/or acid wash, or other harmful contaminants.
- B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.8 MAINTENANCE SERVICE

- A. Entrance Door Hardware:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. 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 entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 4. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC 500-2014, ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 3. ICC/IBC - International Building Code.
 - 4. NFPA 70 - National Electrical Code.
 - 5. NFPA 80 - Fire Doors and Windows.
 - 6. NFPA 101 - Life Safety Code.
 - 7. NFPA 105 - Installation of Smoke Door Assemblies.
 - 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. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.
- E. 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.
- F. 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.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the

manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.
- F. 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.
- G. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to FEMA P-361 (2015), Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
- H. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship

within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.

- b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
 5. Manufacturers:
 - a. Hager Companies (HA).
 - b. Lawrence Brothers (LA).
 - c. McKinney Products (MK).
- B. Pivots: ANSI/BHMA A156.4, Grade 1; space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.
 1. Manufacturers:
 - a. Accurate Lock and Hardware (AC).
 - b. Architectural Builders Hardware (AH).
 - c. Rixson (RF).
- C. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
 1. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
 2. Manufacturers:
 - a. Hafele Manufacturing (HF).
 - b. Johnson Hardware (JO).
 - c. Pemko Products (PE).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
 - a. Hager Companies (HA) - ETW-QC (# wires) Option.
 - b. Lawrence Brothers (LA) - (# wires) Option.
 - c. McKinney Products (MK) - QC (# wires) Option.
- B. Electrified Quick Connect Intermediate Transfer Pivots: Provide electrified offset intermediate transfer pivot hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. 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. Accurate Lock and Hardware (AC) - (# wires).
 - b. Architectural Builders Hardware (AH) - EL019-EZ (# wires).
 - c. Norton Rixson (RF) - E-M19-QC (# wires).
- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney Products (MK) - Connector Hand Tool: QC-R003.
 2. Manufacturers:
 - a. Hager Companies (HA) - Quick Connect.
 - b. McKinney Products (MK) - QC-C Series.
- D. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

2.4 DOOR OPERATING TRIM

- A. 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. 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.
 - 2. 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.
 - 3. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - 4. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products (RO).
 - c. Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 - 1. Manufacturers:
 - a. Schlage (SC).
- 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. New System: Key locks to a new key system as directed by the Owner.
- D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3) each.
2. Master Keys (per Master Key Level/Group): Five (5) each.
3. Construction Keys: Ten (10) each.

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).
 - c. Telkee (TK).

2.7 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Heavy duty mortise locks shall have a ten-year warranty.
2. Where specified, provide status indicators with highly reflective color and wording for "locked/unlocked" or "vacant/occupied" with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1" x 0.6" with a curved design allowing a 180-degree viewing angle with protective covering to prevent tampering.
3. Manufacturers:
 - a. Corbin Russwin (RU) - ML2000 Series.
 - b. Sargent Manufacturing (SA) - 8200 Series.
 - c. Schlage (SC) - L9000 Series.

- B. Multi-Point Locksets, FEMA: ANSI/BHMA A156.37, Certified Products Directory (CPD) listed three-point locking system device engineered for in-swinging and out-swinging door applications on windstorm safe shelter rooms. Extra heavy duty steel component construction securing the door to the frame at top, bottom and center latch positions. All three latching points are automatically activated when the device is locked. Multi-Point Deadlocking System shall be used only with doors, frames and associated hardware that have been engineered, tested and approved for a complete opening assembly system.
1. ANSI-BHMA listed to A156.37 Grade 1 for multi-point locks:
 - a. Lever torque to retract all bolts less than 28 in.lb.
 - b. Cycle tested to 1,000,000 cycles.
 2. NFPA 80 and NFPA 101 life safety requirements.
 3. UL10B or UL10C, 3-hour fire rated openings.
 4. Latchbolt Construction:
 - a. Center Bolt to be one piece, $\frac{3}{4}$ " throw anti-friction stainless steel latch and one piece, 1" throw, hardened stainless steel deadbolt; 2-3/4" standard backset.
 - b. Top and Bottom Bolts to be $\frac{3}{4}$ " x $\frac{3}{4}$ " stainless steel square latchbolt with $\frac{3}{4}$ " projection.
 5. Independent top and bottom bolt projection shall be field adjustable:
 - a. From the center mortise pocket.
 - b. Ability to make field adjustments while the door is in the hung position without the removal of the door.
 - c. Top and Bottom Bolts and the Center Mortise Case shall be factory installed into the door assembly.
 6. Bottom strike shall be offset and reversible to accommodate alignment issues due to rough opening tolerances.
 7. Devices must be able to accommodate sectional rose and lever trim to match the design style and architectural finishes of the balance of the lockset and latches as specified.
 8. Devices must be available with electronic access control options for higher or everyday use and traceability.
 9. Devices must be available with rod-dogging indicator options:
 - a. Operated by single-point latching for non-emergency or normal use of the space.
 - b. Ability to hold rods in a retracted state.
 - c. Day-to-day operations with mortise lock only.
 - d. Indicator to show status.
 10. Manufacturers:

- a. Corbin Russwin (RU) - FE6600 Series.
 - b. Sargent Manufacturing (SA) - FM7300 Series.
 - c. Schlage (SC) - LM9300.
- C. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
 - 1. Locks shall meet or exceed the requirements of ANSI/BHMA A156.2 Series 4000, Grade 1 with all standard trims, as follows:
 - a. Cycle Test: ANSI/BHMA A156.2 Grade 1 requirements with no lever sag.
 - b. Abusive Locked Lever Torque: Exceed 3,100 in-lb with no entry; lock to maintain egress functionality in compliance with BHMA certification requirements.
 - c. Offset Lever Pull: Exceed 1,600 lbs with no entry (8 times ANSI/BHMA A156.2 requirements).
 - d. Latch Retraction with Preload: Exceed 100 lb preload while maintaining ANSI/BHMA requirements for operation in warped doors (2 times ANSI/BHMA A156.2 requirements).
 - 2. Heavy duty cylindrical locks shall have a seven-year warranty.
 - 3. Vertical Impact: Exceed 100 vertical impacts (20 times ANSI/BHMA A156.2 requirements).
 - 4. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
 - 5. Locks are to be non-handed and fully field reversible.
 - 6. Manufacturers:
 - a. Corbin Russwin (RU) - CLX3300 Series.
 - b. Sargent Manufacturing (SA) - 10X Line.
 - c. Schlage (SC) - ND Series.

2.8 ELECTROMECHANICAL LOCKING DEVICES

- A. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.
 - 1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.
 - 2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - CLX33900 Series.
 - b. Sargent Manufacturing (SA) - 10XG71 Series.

- c. Schlage (SC) - ND DEL/DEU 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. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 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 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. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Extended cycle test: Devices to have been cycle tested to 9 million cycles.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Corbin Russwin (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) - 35A/98XP Series.

2.11 ELECTROMECHANICAL EXIT DEVICES

- A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices subject to same compliance standards and requirements as mechanical exit devices. Electrified exit devices to be of type and design as specified below and in the hardware sets.
1. Energy Efficient Design: Provide devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
 2. Where conventional power supplies are not sufficient, include any specific controllers required to provide the proper inrush current.
 3. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
 4. Manufacturers:
 - a. Corbin Russwin (RU) – ED4000/ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) - 35A/98XP Series.

2.12 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 (Large Body Cast Iron): 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 body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 25-year warranty.
2. Manufacturers:
 - a. Corbin Russwin (RU) - DC8000 Series.
 - b. LCN Closers (LC) - 4040XP Series.
 - c. Sargent Manufacturing (SA) - 281 Series.

C. 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 25-year warranty.
2. Manufacturers:
 - a. Corbin Russwin (RU) - DC6000 Series.
 - b. LCN Closers (LC) – 4040XP Series.
 - c. Sargent Manufacturing (SA) - 351 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. Corbin Russwin (RU) - DC5000 Series.
 - b. Norton Door Controls (NO) - 2800ST Series.
 - c. Sargent Manufacturing (SA) - 422 Series.

2.13 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. Rockwood Products (RO).
- c. Trimco (TC).

2.14 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. Rockwood Products (RO).
- c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

- a. Rixson (RF).
- b. Rockwood Products (RO).
- c. Sargent Manufacturing (SA).

2.15 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 Products (PE).
 - 3. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

- A. 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. Security Door Controls (SD) - DPS Series.
 - c. Securitron (SU) - DPS Series.
- B. Switching Power Supplies: Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power supplies shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:
 - a. Securitron (SU) - AQD Series.

2.17 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.

2.18 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. 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.

S□□ 1 – Exterior Entry

Doors: 100A

1 Pivot (Set)	147	626	RF
1 Intermediate Pivot	M19	626	RF

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1 Push/Pull US32D	(2) RM2210 x 24" x Type 5HD mounting x 2" thick RO door		
1 Closer	351 P10 x 581-2	EN	SA
1 Mounting Plate	351-D	EN	SA
1 Overhead Stop	69XS x 90 deg	US26D	SA
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	345 AV x DOW		PE
1 Drip Strip	346 C x DOW + 4"		PE

Gasketing furnished by frame manufacturer

S□ 1.1 – Entry Vestibule

Doors: 100B

1 Pivot (Set)	147	626	RF
1 Electric Intermediate Pivot	E-M19 x QC-12	626	RF
1 ElectroLynx Harness <i>(Install between electric intermediate pivot and junction box)</i>	QC-C1500P		MK
1 Electric Latch Retraction Exit Device (Fail Secure)	AD8504 F x less pull x less cylinder x US32D	31 43 56 LD SA	
1 ElectroLynx Harness <i>(Install between electric intermediate pivot and electric latch retraction exit device)</i>	QC-CXXX x required length		MK
1 Rim Cylinder SC	To match facility key system x CMK x MK		.626
1 Pull US32D	RM2240 x 24" x Type 12XHD mounting x 2" thick RO door		
1 Closer	351 P10 x 581-2	EN	SA
1 Overhead Stop	69XS x 90 deg	US26D	SA
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	321 CN x DOW		PE
1 Card Reader OT	Furnished and installed by security contractor		
1 Door Position Switch	DPS-M-BK		SU
1 Power Supply	AQD4		SU
1 Wiring Diagram	WD-SYSPK		SA

Gasketing furnished by frame manufacturer

Card reader to be used by authorized persons to gain entry from the pull side of the opening

Card reader to be used to retract the latch of the electric latch retraction exit device

Push bar of the electric latch retraction exit device always free for immediate egress

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

S□□2 – Corridor Toilet

Doors: 101, 103

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set & Indicator	8265 LNND x EMB x V21	US26D	SA
1 Closer	422 CTB2	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608-RKW		RO

S□□3 – Utility

Doors: 105

3 Hinge	TA2714 4-1/2" x 4-1/2" NRP	US26D	MK
1 Storeroom Lockset	10XG04 LND x less cylinder x cylinder prep		
US26D	SA		
1 Key-in Lever Cylinder	To match facility key system x CMK x MK		.626
SC			
1 Closer/Stop	351 CPS	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
3 Silencer	608-RKW		RO

S□□4 – Conference

Doors: 106

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	10XU15 LND	US26D	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608-RKW		RO

S□□5 – Office

Doors: 108

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lockset	10XG05 LND x less cylinder x cylinder prep		
US26D	SA		
1 Key-in Lever Cylinder	To match facility key system x CMK x MK		.626
SC			
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608-RKW		RO
1 Coat Hook	RM802	US26D	RO

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

S□□6 – Corridor

Doors: 109A

3 Hinge	T4A3786 5" x 5"	US26D	MK
1 Exit Device	16 31 43 8815 F x 715-8 ETND x less cylinder x 2"		
US32D	SA		
	thick door		
1 Mortise Cylinder	To match facility key system x CMK x MK		.626
SC			
1 Closer	422 CTB2	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608-RKW		RO

S□□7 – Exterior BayKitchen/Ramp

Doors: 109B, 114B, 116A, 116B, 119D, 119E

1 Pivot (Set)	147	626	RF
1 Electric Intermediate Pivot	E-M19 x QC-12	626	RF
1 ElectroLynx Harness	QC-C1500P		MK
<i>(Install between electric intermediate pivot and junction box)</i>			
1 Electric Latch Retraction Exit Device (Fail		31 43 56 LD	
AD8504 F x less pull x less cylinder x	US32D	SA	
Secure)	2" thick door x 24VDC		
1 ElectroLynx Harness	QC-CXXX x required length		MK
<i>(Install between electric intermediate pivot and electric latch retraction exit device)</i>			
1 Rim Cylinder	To match facility key system x CMK x MK		.626
SC			
1 Pull	RM2240 x 24" x Type 12XHD mounting x 2" thick		
US32D	RO		
	door		
1 Closer	351 P10 x 581-2	EN	SA
1 Mounting Plate	351-D	EN	SA
1 Overhead Stop	69XS x 90 deg	US26D	SA
1 Threshold	170 A x DOW x MS & ES25		PE
1 Door Bottom Seal	345 AV x DOW		PE
1 Drip Strip	346 C x DOW + 4"		PE
1 Card Reader	Furnished and installed by security contractor		
OT			
1 Door Position Switch	DPS-M-BK		SU
1 Power Supply	AQD4		SU
1 Wiring Diagram	WD-SYSPK		SA

Gasketing furnished by frame manufacturer

Card reader to be used by authorized persons to gain entry from the exterior side of the opening

Card reader to be used to retract the latch of the electric latch retraction exit device

Push bar of the electric latch retraction exit device always free for immediate egress

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

S□ 8 – Ramp

Doors: [109C](#), [114C](#)

2 Hinge	T4A3386 4-1/2" x 4-1/2" NRP	US32D	MK
1 Electric Hinge (Install at middle hinge)	T4A3386 4-1/2" x 4-1/2" QC-12	US32D	MK
1 ElectroLynx Harness (Install between electric hinge and junction box)	QC-C1500P		MK
1 Mortar Box	MG-16	US2C	MK
1 Electrified Exit Device (Fail Secure) US32D	43 LD 8876 F x 776-8 ETND x less cylinder x SA 24VDC		
1 ElectroLynx Harness	QC-CXXX x required length		MK
1 Rim Cylinder SC	To match facility key system x CMK x MK		.626
1 Closer	351 P10	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Threshold	1715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Door Bottom Seal	321 CN x DOW		PE
1 Card Reader OT	Furnished and installed by security contractor		
1 Door Position Switch	DPS-M-BK		SU
1 Power Supply	AQD4		SU
1 Wiring Diagram	WD-SYSPK		SA

Card reader to be used by authorized persons to gain entry from the pull side of the opening
Card reader to be used to unlock the pul side lever of the electrified exit device
Push bar of the electrified exit device always free for immediate egress

S□ 9 – EMS Storage

Doors: [110](#)

3 Hinge	T4A3386 4-1/2" x 4-1/2"	US32D	MK
1 Storeroom Lockset US26D	10XG04 LND x less cylinder x cylinder prep SA		
1 Key-in Lever Cylinder SC	To match facility key system x CMK x MK		.626
1 Closer	351 O	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Door Stop	481	US26D	RO
1 Threshold	1715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Door Bttom Seal	321 CN x DOW		PE

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

S□□ 10 – Decon/Lockers/Toilet

Doors: [111](#), [112B](#), [113B](#)

3 StormPro Hinge	SP3386 4-1/2" x 4-1/2"	US32D	MK
1 Multi-Point Lockset	FM7325 LNND x less cylinder	US26D	SA
1 Mortise Cylinder SC	To match facility key system x CMK x MK		.626
1 Closer	281 O x TB	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Door Stop	481	US26D	RO
<i>(For door 111 only)</i>			
1 Threshold	2715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S773 BL x DOW x DOH		PE
1 Door Bottom Seal	345 AV x DOW		PE
1 Drip Strip	346 C x DOW + 4"		PE

S□□ 11 – Decon

Doors: [112A](#)

3 Hinge	T4A3786 4-1/2" x 4-1/2"	USP	MK
1 Passage Set	10XU15 LND	US26D	SA
1 Closer	422 CTB2	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Threshold	1715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Door Bottom Seal	321 CN x DOW		PE

S□□ 12 – Toilet

Doors: [113A](#)

3 Hinge	TA2714 4-1/2" x 4-1/2"	USP	MK
1 Privacy Set & Indicator	8265 LNND x EMB x V21	US26D	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608-RKW		RO

S□□ 13 – Corridor

Doors: [114A](#)

3 Hinge	T4A3786 5" x 5"	US26D	MK
1 Exit Device	16 31 43 8815 J x 715-8 ETND x less cylinder x 2"		
US32D	SA		

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

	thick door		
1 Mortise Cylinder SC	To match facility key system x CMK x MK		.626
1 Closer	422 CTB2	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608-RKW		RO

S□□14 – Janitor

Doors: 115

3 Hinge	TA2714 4-1/2" x 4-1/2" NRP	US26D	MK
1 Classroom Lockset US26D	10XG37 LND x less cylinder x cylinder prep SA		
1 Key-in Lever Cylinder SC	To match facility key system x CMK x MK		.626
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
1 Overhead Stop	59XS x 90 deg	US26D	SA
3 Silencer	608-RKW		RO

S□□15 – Roll-up Door

Doors: 119A, 119B, 119C, 119F, 119G, 119H

All hardware furnished by door manufacturer

S□□16 – Utility

Doors: 120

3 Hinge	TA2314 4-1/2" x 4-1/2" NRP	US32D	MK
1 Storeroom Lockset US26D	10XG04 LND x less cylinder x cylinder prep SA		
1 Key-in Lever Cylinder SC	To match facility key system x CMK x MK		.626
1 Closer/Stop	351 CPS	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Threshold	1715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Door Bottom Seal	321 CN x DOW		PE

S□□17 – Shop

Doors: 121A

3 Hinge	TA2314 4-1/2" x 4-1/2"	US32D	MK
1 Passage Set	10XU15 LND	US26D	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1 Wall Stop	406	US32D	RO
1 Threshold	1715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Door Bottom Seal	321 CN x DOW		PE

S□□18 – Utility

Doors: 121B

3 Hinge	TA2714 4-1/2" x 4-1/2" NRP	USP	MK
1 Storeroom Lockset	10XG04 LND x less cylinder x cylinder prep		
US26D	SA		
1 Key-in Lever Cylinder	To match facility key system x CMK x MK		.626
SC			
1 Closer/Stop	351 CPS	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
3 Silencer	608-RKW		RO

S□□19 – Exercise

Doors: 122A

3 Hinge	T4A3386 4-1/2" x 4-1/2" NRP	US32D	MK
1 Passage Set	10XU15 LND	US26D	SA
1 Closer/Stop	351 CPS	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Threshold	1715 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Door Bottom Seal	321 CN x DOW		PE

S□□20 – Exterior Exercise

Doors: 122B

2 Pivot (Set)	147	626	RF
2 Intermediate Pivot	M19	626	RF
1 Exit Device	16 43 AD8410 F x 106 x less cylinder x less pull		
US32D	SA		
1 Exit Device	16 43 AD8410 F x less cylinder	US32D	SA
3 Mortise Cylinder	To match facility key system x CMK x MK		.626
SC			
2 Pull	RM2240 x 24" x Type 12XHD mounting x 2" thick		
US32D	RO		
	door		
2 Closer	351 P10 x 581-2	EN	SA
2 Mounting Plate	351-D	EN	SA
2 Overhead Stop	69XS x 90 deg	US26D	SA
1 Threshold	170 A x DOW x MS & ES25		PE
2 Door Bottom Seal	345 AV x DOW		PE

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1 Astragal (Set)	(2) 297 AS x DOH		PE
1 Drip Strip	346 C x DOW + 4"		PE
2 Door Position Switch	DPS-M-BK		SU

Gasketing furnished by frame manufacturer

S□□ 21 – Stair

Doors: 200

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device	12 43 8815 F x 715-8 ETND	US32D	SA
1 Closer	422 CTB2	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
3 Silencer	608-RKW		RO

S□□ 22 – Corridor Storage/Laundry/Lockers

Doors: 202, 203, 205, 207, 208, 209, 210, 211, 212, 213

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	10XU15 LND	US26D	SA
1 Closer	422 CTB2	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" x 1" LDW 4BE CSK	US32D	RO
<i>(For door 205 only)</i>			
1 Wall Stop	406	US32D	RO
1 Gasketing (Set)	S88 BL x DOW x DOH		PE

S□□ 23 – Pocket Door

Doors: 202A, 202B, 203A, 203B, 208A, 208B, 209A, 209B, 210A, 210B, 211A, 211B, 212A, 212B, 213A, 213B

1 Pocket Door Hardware (Set)	PF28200A7284		PE
1 Pocket Door Privacy Set	891	US26D	RO

S□□ 24 – Mezzanine

Doors: 204B

3 Hinge	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	10XU15 LND	US26D	SA
1 Closer	351 P10	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Threshold	171 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE

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DOOR HARDWARE

City of Lee's Summit
 Fire Station
 Lee's Summit, Missouri

1 Door Bottom Seal	234 AV x DOW	PE
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S□ 25 – Mechanical Room

Doors: 206

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lockset	10XG04 LND x less cylinder x cylinder prep		
US26D	SA		
1 Key-in Lever Cylinder	To match facility key system x CMK x MK		.626
SC			
1 Closer	351 O	EN	SA
1 Kickplate	K1050 10" x 2" LDW 4BE CSK	US32D	RO
1 Door Stop	481	US26D	RO
1 Threshold	151 A x DOW x MS & ES25		PE
1 Gasketing (Set)	S88 BL x DOW x DOH		PE
1 Automatic Door Bottom	434 APKL x DOW		PE

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements: Section 088813 "Fire-Rated Glazing."

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 - 1. Tinted glass.
 - 2. Laminated glass.
 - 3. Insulating glass.
- C. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between 2 strips of material representative in color of adjoining framing system.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Preconstruction adhesion and compatibility test report.
- D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: 115 mph (3-second gust)
 - c. Importance Factor: 1.0.
 - d. Exposure Category: B.
 - 2. Maximum Lateral Deflection: For glass supported on all 4 edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- C. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for enhanced protection.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 - 2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x degrees F.
 - 4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 - 5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least 1 component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AGC Glass Company North America, Inc.
 - b. Cardinal Glass Industries, Inc.
 - c. Guardian Glass; SunGuard.
 - d. Pilkington North America.
 - e. Viracon.
 - f. Vitro Architectural Glass.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Perimeter Spacer: Aluminum with bronze, color anodic finish.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Technoform.
 - 2) Thermix; a brand of Ensinger USA.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Adfast.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. May National Associates, Inc.: a subsidiary of Sika Corporation.
 - d. Pecora Corporation.
 - e. Polymeric Systems, Inc.
 - f. Sika Corporation.
 - g. The Dow Chemical Company.
 - h. Tremco Incorporated.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Type recommended in writing by sealant or glass manufacturer.
- D. Spacers: Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks: Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

- a. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into 1 side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in 1 continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.

- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry

surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than 4 days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type: Fully tempered float glass.
 1. Minimum Thickness: 6 mm.
 2. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

- A. Low-E-Coated, Tinted Insulating Glass Type:
 1. Basis-of-Design Product: Viracon.
 2. Overall Unit Thickness: 1 inch.
 3. Minimum Thickness of Each Glass Lite: 6 mm.
 4. Outdoor Lite: Tinted fully tempered float glass.
 5. Tint Color: Viracon's Solar Blue or similar.
 6. Interspace Content: Argon.
 7. Indoor Lite: Clear fully tempered float glass.
 8. Low-E Coating: Sputtered on third surface.
 9. Winter Nighttime U-Factor: 0.34 maximum.
 10. Summer Daytime U-Factor: 0.32 maximum.
 11. Visible Light Transmittance: 50 percent minimum.
 12. SGHC: 0.44 maximum.
 13. Safety glazing required.

END OF SECTION 088000

SECTION 088300 - MIRRORS

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 the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.
- B. Related Sections:
 - 1. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
- D. Glazing Publications: Comply with the following published recommendations:
 - 1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
 - 2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Industries.
 - b. National Glass Industries.
 - c. Virginia Mirror Company, Inc.
 - d. Walker Glass Co., Ltd.

2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

2.3 MIRROR HARDWARE

- A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.
 2. Finish: Clear bright anodized.
- B. Top Channel/Cleat and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
 1. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch in height, respectively.
 - a. Product: Subject to compliance with requirements, provide D638 FHA Type "J" Channel by Laurence, C. R. Co., Inc.
 2. Top Trim: Formed with front leg with a height of 5/16 inch and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
 - a. Product: Subject to compliance with requirements, provide D 1638 Top Channel and D 1637M Mirror Mount System Cleat by Laurence, C. R. Co., Inc.
 3. Finish: Clear bright anodized.
- C. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

- D. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

- A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.
- B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Rounded polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
 - 2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 088813 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection-rated glazing.
2. Fire-resistance-rated glazing.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing that prevents spread of fire and smoke and complies with requirements for rated openings; incapable of blocking radiant heat
- B. Fire-Resistance-Rated Glazing: Glazing that prevents spread of fire and smoke and radiant heat and complies with requirements for rated walls and rated openings; capable of blocking radiant heat
- C. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- D. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and glass testing agency.

- B. Product Certificates: For each type of glass and glazing product.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

- 1. Warranty Period: 5 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Tempered Glazing Units with Clear Intumescent Interlayer: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of tempered glazing units with clear intumescent interlayer is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is air bubbles within units, or obstruction of vision by contamination or deterioration of intumescent interlayer.

- 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Glass: For each glass type, obtain from single source from single manufacturer.
- B. Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- B. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.
 - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 degrees F temperature-rise limitation; and fire-resistance rating in minutes.
- C. Fire-Protection-Rated Tempered Glass: 6-mm thickness; fire-protection-rated tempered glass; complying with 16 CFR 1201, Category II.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. SAFTI FIRST Fire Rated Glazing Solutions.
 - b. Technical Glass Products.
 - c. Vetrotech Saint-Gobain.
- D. Fire-Protection-Rated Monolithic Glass for Doors and Protected Openings: 19-mm thickness.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. SAFTI FIRST Fire Rated Glazing Solutions.
 - b. Schott North America, Inc.
- E. Fire-Protection-Rated Tempered Glazing Units with Clear Intumescent Interlayer: Double glazing units made from 2 or more lites of uncoated, fully tempered, clear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, semi-solid, intumescent polymer; complying with 16 CFR 1201, Category II.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. SAFTI FIRST Fire Rated Glazing Solutions.

2.6 FIRE-RESISTANCE-RATED GLAZING

- A. General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing in accordance with ASTM E119 or UL 263.
- B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that glazing is approved for use in walls, and fire-resistance rating in minutes.
- C. Fire-Resistance-Rated Framing and Doors: Fire-resistance-rated glazing with 60-, 90-, and 120-minute ratings requires framing and doors from glass supplier, tested as an assembly complying with ASTM E119 or UL 263.
- D. Fire-Resistance-Rated Tempered Glazing Units with Clear Intumescent Interlayer: Glazing units made from 2 or more lites of uncoated, fully tempered, clear float glass; with a perimeter edge seal enclosing a cavity filled with optically clear, intumescent polymer; complying with 16 CFR 1201, Category II.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. SAFTI FIRST Fire Rated Glazing Solutions.

2.7 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- C. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- D. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.

END OF SECTION 088813

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

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. Non-load-bearing steel framing systems for interior gypsum board assemblies.
 - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

- B. Related Requirements:

- 1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; and ceiling joists.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For dimpled steel studs and runners, from ICC-ES.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.027 inch.
 - b. Depth: As indicated on Drawings.
 - 2. Dimpled Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.025 inch .
 - b. Depth: As indicated on Drawings.
- C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: 7/8 inch.
- D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches , wall attachment flange of 7/8 inch , minimum uncoated-metal thickness of 0.018 inch , and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 24 inches o.c. unless otherwise indicated.
 - 2. Tile Backing Panels: 24 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - 4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
 - 1. Erect insulation, specified in Division 07 Section "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Hangers: 48 inches (1219 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Do not attach hangers to steel roof deck.
 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

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Lee's Summit, Missouri

- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
3. Section 093000 "Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-(300-mm-)long length for each trim accessory indicated.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Georgia-Pacific Building Products.
 2. National Gypsum Company.
 3. United States Gypsum Company.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 1. Thickness: 5/8 inch (15.9 mm).
 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 1. Thickness: 1/2 inch (12.7 mm).
 2. Long Edges: Tapered.

- D. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Continental Building Products, LLC.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 2. Core: 5/8 inch (15.9 mm), abuse resistant.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Continental Building Products, LLC
 - b. Georgia-Pacific Building Products
 - c. National Gypsum Company
 2. Core: 5/8 inch , Type X
 3. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements
 4. Indentation: ASTM C1629/C1629M, meets or exceeds Level 3 requirements
 5. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements
 6. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 3 requirements according to test in Annex A1
 7. Long Edges: Tapered
 8. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274

2.4 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 2. Core: 5/8 inch (15.9 mm), Type X.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-(6.4- to 9.5-mm-)wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-(6.4- to 12.7-mm-)wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: As indicated on Drawings.
 - 2. Type X: As indicated on Drawings and where required for fire-resistance-rated assembly.
 - 3. Ceiling Type: As indicated on Drawings.
 - 4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
 - 5. Glass-Mat Interior Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. L-Bead: Use where indicated.
 - 4. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.

3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

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. Porcelain tile.
 - 2. Stone thresholds.
 - 3. Crack isolation membrane/Waterproofing Membrane.
 - 4. Mortars and Grouts.
 - 5. Metal edge strips.

- B. Related Sections:

- 1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Division 09 Section "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.6.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
 3. Full-size units of each type of trim and accessory for each color and finish required.
 4. Stone thresholds in 6-inch lengths.
 5. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

1.7 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.8 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Crack isolation membrane.
 - 3. Joint sealants.
 - 4. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.

- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

- A. Tile Type PT: Porcelain tile.
 - 1. Basis-of-Design Product: Daltile – Archaia
 - 2. Location: As shown on drawings.
 - 3. Composition: Porcelain.
 - 4. Face Size: and 12 x 24 as indicated on drawings
 - 5. Thickness: 10.5 mm.
 - 6. Face: Plain with square or cushion edges.
 - 7. Tile Color and Pattern: Atlas Gray AR43
 - 8. Grout Color: As selected by architect from manufacturer's full range.
 - 9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cove: Bullnose 3x24
 - b. Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size same as adjoining flat tile.
 - c. External Corners for Thin-Set Mortar Installations: Surface bullnose, module size same as adjoining flat tile.
 - d. Internal Corners: Cove, module size same as adjoining flat tile.
 - e. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.
 - 1. Description: Uniform, fine- to medium-grained white stone with gray veining.
 - 2. Description: Match Architect's sample.

2.4 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements,:
 - a. Noble Company (The); Nobleseal CIS.
 - b. Or approved equal
- C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements,:
 - a. Compotite Corporation; Composeal Gold.
 - b. Or approved equal
- D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements,:
 - a. Schluter Systems L.P.; KERDI.
 - b. Or approved equal
- E. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements,:

- a. Schluter Systems L.P.; DITRA.
 - b. Or approved equal
- F. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements,:
 - a. National Applied Construction Products, Inc.; Strataflex.
 - b. Or approved equal
- G. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
 - b. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.
 - c. MAPEI Corporation; Mapelastic L (PRP M19).
 - d. Summitville Tiles, Inc.; S-9000.
- H. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. C-Cure; UltraCure 971.
 - b. MAPEI Corporation; Mapelastic (PRP 315).
 - c. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.
- I. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.
 - 1. Products: Subject to compliance with requirements,:
 - a. Bostik, Inc.; Hydroment Ultra-Set.
 - b. Or approved equal

2.5 SETTING MATERIALS

- A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.

- b. Southern Grouts & Mortars, Inc.
 - c. Summitville Tiles, Inc.
 - d. TEC; a subsidiary of H. B. Fuller Company.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
- B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Southern Grouts & Mortars, Inc.
 - c. Summitville Tiles, Inc.
 - d. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
 - 4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- C. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Southern Grouts & Mortars, Inc.
 - c. Summitville Tiles, Inc.
 - d. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
- D. Thick-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 1-1/2 inches.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Southern Grouts & Mortars, Inc.
 - c. Summitville Tiles, Inc.

- d. TEC; a subsidiary of H. B. Fuller Company.
2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.

2.6 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.7 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
 1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
 - c. Laticrete International, Inc.; Latacil Tile & Stone Sealant.
 - d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - e. Tremco Incorporated; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; Chem-Calk 550.
 - b. Pecora Corporation; NR-200 Urexpan.

- c. Tremco Incorporated.; THC-900.
- E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.
 - 1. Manufacturers: Subject to compliance with requirements,:
 - a. Atlas Minerals & Chemicals, Inc.
 - b. Or approved equal

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
- C. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
 - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bonsal American; an Oldcastle company; Grout Sealer.
 - b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Grout and Tile Sealer.
 - e. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
 - f. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
 - g. TEC; a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
 - c. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Paver Tile: 1/4 inch.
 - 2. Wall Tile: 1/16 inch .
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - 2. Do not extend waterproofing or crack isolation membrane under thresholds set in dry-set portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- K. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

- A. Install backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093000

SECTION 095123 - ACOUSTICAL TILE CEILINGS

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. Acoustical tiles for ceilings.
 - 2. Concealed suspension systems.
- B. Related Requirements:
 - 1. Division 09 Section "Acoustical Panel Ceilings" for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
 - 2. Concealed Suspension-System Members: 6-inch- long Sample of each type.
 - 3. Exposed Moldings and Trim: Set of 6-inch- long Samples of each type and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Minimum Drawing Scale: 1/8 inch = 1 foot.

- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
 2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL TILES, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.
- C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply

with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL TILES

1. ACT: Basis-of-Design Product: Subject to compliance with requirements, provide Rockfon: "Rockfon Sonar" or comparable product by one of the following:
 - a. Armstrong Industries, Inc.
 - b. CertainTeed Corp.
 - c. USG Interiors, Inc.; Subsidiary of USG Corporation.
2. Classification: Provide tiles complying with ASTM E 1264 for type, form, and pattern as follows:
 - a. Type and Form: Type SLN, painted finish; Form E.
 - b. Pattern: As indicated by manufacturer's designation.
3. Color: White. Paint cut edges of all tegular tile white to match tile face.
4. LR: Not less than 0.85.
5. NRC: Not less than 0.95.
6. CAC: Not less than 23.
7. Edge/Joint Detail: Angled Tegular.
8. Thickness: 1 inch.
9. Grid Size: 15/16"
10. Modular Size: As indicated on Drawings.
11. Humigard Plus

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC 1 service condition.

- b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
- 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

2.5 METAL SUSPENSION SYSTEM

- A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
 - 1. Rockfon
 - 2. Armstrong World Industries, Inc.
 - 3. CertainTeed Corp.
 - 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. Access: Upward and side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.
 - a. Initial Access Opening: In each module, 24 by 24 inches.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Products: Subject to compliance with requirements, provide products by one of the following:

1. Rockfon
 2. Armstrong World Industries, Inc.
 3. CertainTeed Corp.
 4. Fry Reglet Corporation.
 5. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips and complying with seismic design requirements and the following:
1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils . Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 MISCELLANEOUS MATERIALS

- A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.
 - 1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Staples: 5/16-inch- long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard

- suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of three tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans.
 2. Install tiles with pattern running in one direction parallel to short axis of space.
 3. Install tiles in a basket-weave pattern.

- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - 1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.
 - 3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. Resilient base.
 - 2. Resilient stair accessories.
 - 3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 QUALITY ASSURANCE

1.6 Mock-ups: Use material where appropriate on wall mock-ups specified in related sections.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F, (35 deg C in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base and stair accessories shall comply with requirements of FloorScore certification.
- B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 THERMOSET-RUBBER BASE, RB

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite or comparable product by one of the following:
1. Armstrong World Industries, Inc.
 2. Johnsonite; A Tarkett Company.
 3. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient flooring
- C. Thickness: 0.25 inch.
- D. Height: 4 inches
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.

- G. Inside Corners: Preformed.

Colors: As selected by Architect from full range of industry colors

2.3 RUBBER STAIR TREADS AND RISERS, RT

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong or comparable product by one of the following:

1. Johnsonite; A Tarkett Company.
2. Roppe Corporation, USA.

- B. Stair Treads: ASTM F 2169.

1. Type: TS (rubber, vulcanized thermoset).
2. Class: 2
3. Group: 1 (embedded abrasive strips) and 2 (with contrasting color for the visually impaired).
4. Nosing Style: Square.
5. Nosing Height: 1-1/2 inches (38 mm)
6. Thickness: 0.210 inches (5.33mm) to 0.153 inch (3.89mm) tapered.
7. Size: Lengths and depths to fit each stair tread in one piece.
8. Integral Risers: Smooth, flat; in height that fully covers substrate.

- C. Locations: Provide rubber stair accessories in areas indicated.

- D. Colors and Patterns: Armstrong – As selected from manufacturers full range.

2.4 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Armstrong World Industries, Inc.
2. Johnsonite; A Tarkett Company.
3. Roppe Corporation, USA.

- B. Description: Rubber reducer strip for resilient flooring joiner for tile and carpet transition strips as indicated on drawings..

- C. Profile and Dimensions: As indicated on drawings.

- D. Locations: Provide rubber molding accessories in areas indicated on drawings.

- E. Colors and Patterns: As indicated or as selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

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. Rubber floor tile.
 - 2. Vinyl composition floor tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- C. Samples: Full-size units of each color and pattern of floor tile required.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. RF, VCT

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 RUBBER FLOORING, RF

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Norament XP or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Johnsonite; A Tarkett Company.
 - 3. Roppe Corporation, USA.
- B. Tile Standard: ASTM F 1700.
- C. Wearing Surface: Hammered.
- D. Thickness: 0.14 inch (3.5 mm).
- E. Size: 39.53 by 39.53 inches (1004 by 1004 mm).
- F. Colors and Patterns: 5111 Castor.

2.3 STATIC-DISSIPATIVE VINYL COMPOSITION FLOOR TILE, VCT (TEL / RADIO)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong VCT – Standard Excelon or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Johnsonite; A Tarkett Company.
 - 3. Roppe Corporation, USA.
- B. Tile Standard: ASTM F 1066.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch (3.2 mm).
- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Adhesives shall comply with the following limits for VOC content:

- a. Vinyl Composition Tile Adhesives: 50 g/L or less.
 - b. Rubber Floor Adhesives: 60 g/L or less.
2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

- b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- F. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubber floor tile.

B. Related Sections:

1. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions of game lines and markers.
4. Locations of floor inserts for athletic equipment installed through flooring.

C. Samples for Initial Selection: For each type of flooring indicated.

D. Samples for Verification: For each type, color, and pattern of flooring indicated, 6-inch-(150-mm-) square Samples of same thickness and material indicated for the Work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For flooring to include in maintenance manuals.

1.4 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish no fewer than 1 unopened carton, of each type, color, pattern, and size of floor tile installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration. Store tiles on flat surfaces.

1.6 FIELD CONDITIONS

- A. Adhesively Applied Products:
 - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
 - 2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
 - 3. Close spaces to traffic during flooring installation.
 - 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

1.7 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of rubber flooring that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Excessive wear.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient athletic flooring shall comply with requirements of FloorScore Standard.

2.2 RUBBER FLOOR TILE, RAF

- A. Manufacturers:
 - 1. Basis of Design: Ecore, Ecosurfaces
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Ecosurfaces – Econights, recycled rubber multi-purpose rubber flooring
 - b. Roppe - Recoil Fitness Flooring, 100% recycled content
 - c. Mondo America – Sports Impact
- B. Description: Athletic flooring consisting of modular rubber tiles with smooth edges for adhered application.
- C. Material: Rubber flooring shall be manufactured with 67% post-consumer recycled content with 1/8" wear layer of 100% virgin rubber vulcanized to a 1/4" performance layer of post-consumer recycled rubber.
- D. Size: 24 inches (610 mm) square.
- E. Thickness: 8 mm.
- F. Color and Pattern: To be selected by Architect from manufacturer's full range of options.
 - 1. Type: Interlocking, loose-lay (no adhesive)

2.3 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
 - 1. Do not install flooring until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 FLOOR TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis.
- B. Discard broken, cracked, chipped, or deformed tiles.
- C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.
 - 1. Lay tiles with grain running in one direction.
- D. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
2. Sweep and vacuum flooring thoroughly.
3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096566

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular, tufted carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.

- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-(300-mm-)long Samples.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 10 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m). In addition, all usable scraps larger than 2 sq. ft. or more than 8 inches in width, shall be turned over to owner.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Master II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE, CPT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Patcraft Mid Century Pop
- B. Color: 0382 Color Block – 00590 Atomic.
- C. Pattern: Squares.
- D. Size: 24"X24" (71 cm X 71 cm).
- E. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- F. Antimicrobial Treatment: Manufacturer's standard material.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove yarns that protrude from carpet tile surface.
 - 2. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099113 - EXTERIOR PAINTING

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 surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete masonry units (CMU).
 - 2. Steel.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099600 "High-Performance Coatings" for special-use coatings.
 - 3. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 4. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. ChemRex.
 - 3. Del Technical Coatings.
 - 4. ICI Paints.
 - 5. Kryton Canada Corporation.
 - 6. McCormick Paints.
 - 7. PPG Architectural Finishes, Inc.
 - 8. Sherwin-Williams Company (The).
 - 9. Vista Paint.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.

2.3 METAL PRIMERS

- A. Primer, Alkyd, Anti-Corrosive for Metal: MPI #79.
 - 1. VOC Content: E Range of E2.

2.4 WATER-BASED PAINTS

- A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 - 1. VOC Content: E Range of E2.

- B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
- C. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - 1. VOC Content: E Range of E2.

2.5 QUICK-DRYING ENAMELS

- A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
- B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - 1. VOC Content: E Range of E2.

2.6 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Masonry (Clay and CMU): 12 percent.

- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove loose surface oxidation.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

- A. CMU Substrates:
 - 1. High-Build Latex System: Dry film thickness not less than 10 mils (0.25 mm).
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build.
- B. Steel Substrates:
 - 1. Quick-Drying Enamel System: MPI EXT 5.1A.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Quick-drying enamel matching topcoat.
 - c. Topcoat: Quick-drying enamel (semigloss).

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Wood.
 - 5. Gypsum board.
- B. Related Requirements:
 - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
 - 2. Section 099600 "High-Performance Coatings" for high-performance and special-use coatings.
 - 3. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
 - 4. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Benjamin Moore & Co.
 2. PPG Architectural Finishes, Inc
 3. Sherwin-Williams Company (The)

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Dry-Fog Coatings: 400 g/L.
 4. Primers, Sealers, and Undercoaters: 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Floor Coatings: 100 g/L.
 9. Shellacs, Clear: 730 g/L.
 10. Shellacs, Pigmented: 550 g/L.
- D. Colors:
1. P-1 – Main Wall Color: SW 7631 'City Loft' [Sheen – Eggshell]
 2. P-2 – Accent Color: SW 7624 'Slate Tile' [Sheen – Eggshell].
 3. P-3 – Accent Color: SW 2814 "Rookwood Antique Gold" [Sheen – Eggshell],
 4. P-4 – Bunk Accent Color: SW 7044 "Amazing Gray" [Sheen – Eggshell]
 5. P-5 – Hollow Metal Door Frame: SW 7675 'Sealskin' [Sheen – Semi-Gloss].
 6. P-6 – Ceiling Color: SW 7005 'Pure White' [Sheen – Flat].

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.

1. VOC content: E Range of E2.

2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E2.

2.6 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

2.7 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 1.5.

B. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

C. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

- D. Interior Latex (Satin): MPI #43 (Gloss Level 4).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 2.
- E. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 3.
- F. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 3.
- G. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 4.
- H. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 5.
- I. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).
 - 1. VOC Content: E Range of.
 - 2. Environmental Performance Rating: EPR 4.5.
- J. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
 - 2. Environmental Performance Rating: EPR 5.

2.8 QUICK-DRYING ENAMELS

- A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
 - 1. VOC Content: E Range of E2.
- B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).
 - 1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
 - 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Tanks that do not have factory-applied final finishes.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Uninsulated metal piping.
 - b. Pipe hangers and supports.
 - c. Metal conduit.
 - d. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - e. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply

additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. CMU Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.

2. Institutional Low-Odor/VOC Water-Based Epoxy System:

- a. Block Filler: Block filler, epoxy, interior/exterior, MPI #3.
- b. Intermediate Coat: Epoxy, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Epoxy, interior, institutional low odor/VOC, egg shell (Gloss Level 3), MPI #115.

B. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.

C. Wood Substrates, Traffic Surfaces:

1. Latex Floor Paint System:

- a. Prime Coat: Primer sealer, alkyd, interior, MPI #45.
- b. Intermediate Coat: Floor paint, latex, low gloss (maximum Gloss Level 3), MPI #60.
- c. Topcoat: Floor paint, latex, low gloss (maximum Gloss Level 3), MPI #60.

D. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

- a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

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 surface preparation and application of wood finishes on the following substrates:
 - 1. Interior Substrates:
 - a. Dressed lumber (finish carpentry).
- B. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for standard paint systems on exterior substrates.
 - 2. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.
 - 3. Section 099600 "High-Performance Coatings" for transparent high-performance coatings on concrete floors and clay masonry.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- D. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

- B. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.
 - 1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.
 - 2. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
 - 1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.
 - 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior stains and finishes applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 - 2. Shellacs, Clear: VOC not more than 730 g/L.
 - 3. Stains: VOC not more than 250 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
- D. Stain Colors: To match VT Industries – White Birch – Clear CL18.

2.2 WOOD FILLERS

- A. Wood Filler Paste: MPI #91.
 - 1. VOC Content: E Range of E2.

2.3 STAINS

- A. Stain, Exterior, Water Based, Solid Hide: MPI #16.

2.4 POLYURETHANE VARNISHES

- A. Varnish, Polyurethane, Moisture-Cured, Gloss (Gloss Level 6): MPI #31.
 - 1. VOC Content: E Range of E2.

2.5 SOURCE QUALITY CONTROL

- A. Testing of Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Interior Wood Substrates:
1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
 3. Sand surfaces that will be exposed to view and dust off.
 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
1. Use applicators and techniques suited for finish and substrate indicated.
 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

- A. Wood substrates, nontraffic surfaces, including wood trim, architectural woodwork, doors.

- 1. Solid-Color Latex Stain System:

- a. Intermediate Coat: Stain, exterior, water based, solid hide, matching topcoat.
 - b. Topcoat: Stain, exterior, water based, solid hide, MPI #16.

- 2. Moisture-Cured Clear Polyurethane System:

- a. Prime Coat: Moisture-cured polyurethane matching topcoat.
 - b. Intermediate Coat: Moisture-cured polyurethane matching topcoat.
 - c. Topcoat: Varnish, polyurethane, moisture-cured, gloss (Gloss Level 6), MPI #31.

END OF SECTION 099300

SECTION 099600 - HIGH-PERFORMANCE COATINGS

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 surface preparation and field application of high-performance coating systems on the following substrates:
 - 1. Interior and exterior steel.
- B. Related Sections include the following:
 - 1. Division 5 Section "Structural Steel" for shop priming structural steel.
 - 2. Division 5 Section "Formed-Metal Fabrications" for shop-primed ferrous metal.
 - 3. Division 9 Section "Painting" for general field painting.
- C. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 DEFINITIONS

- A. Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Gloss ranges used in this Section include the following:
 - 1. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
 - 2. High gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.
- C. Environments: The following terms are used in Part 2 of this Section to distinguish between different corrosive exposures:
 - 1. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

1.4 SUBMITTALS

- A. Product Data: For each coating system indicated. Include block fillers and primers.
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
 - 1. After color selection, Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate.
 - 1. Provide stepped Samples defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. List of material and application for each coat of each sample. Label each sample for location and application.
 - 3. Submit samples on the following substrates for Architect's review of color and texture:
 - a. Ferrous and Nonferrous Metal: Provide two 4-inch- square samples of flat metal and two 8-inch- long samples of solid metal for each color and finish.
- D. 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.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.
- B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
 - 1. Architect will select one room, area, or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Small Areas and Items: Architect will designate items or areas required.
 - 2. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
 - 1. Name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. Handling instructions and precautions.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F . Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.7 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F .
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.
2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products indicated in the coating system descriptions.
- B. Manufacturers' Names: The following manufacturers are referred to in the coating system descriptions by shortened versions of their names shown in parenthesis:
 1. Moore: Benjamin Moore & Co. (Moore).
 2. Pittsburgh Paint; PPG Industries, Inc. (PPG).
 3. Sherwin Williams; Industrial and Marine Coatings (S-W).
 4. Tnemec Company, Inc. (Tnemec).

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 3. Provide products of same manufacturer for each coat in a coating system.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
 4. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: 250 g/L.

5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
6. Pre-Treatment Wash Primers: 420 g/L.
7. Floor Coatings: 100 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by Architect from manufacturer's full range.

2.3 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Ferrous Metal: Provide the following finish systems over exterior ferrous-metal surfaces:

1. Moderate Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.
 - a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.
 - 1) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
 - 2) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
 - 3) S-W: Recoatable Epoxy Primer B67 Series/B67V5.
 - 4) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.
 - b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 8.0 mils .
 - 1) S-W: Heavy Duty Epoxy B67W300 Series.
 - 2) Tnemec: Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.
 - c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils .
 - 1) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
 - 2) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
 - d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils .
 - 1) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
 - 2) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.

- 3) S-W: Corothane II Satin B65W200 Series.
- 4) Tnemec: Series 75 Endura-Shield.

B. Nonferrous Metal: Provide the following finish systems over exterior nonferrous-metal surfaces:

- 1. Moderate Environment (Semigloss Finish): One finish coat over an intermediate coat and a primer.
 - a. Primer: Epoxy primer applied at spreading rate recommended by manufacturer.
 - 1) Moore: M36-00/M37 Polyamide Epoxy Clear Sealer/Finish.
 - 2) PPG: 97-14XX Series Pitt-Guard DTR Polyamide Epoxy Coating.
 - 3) S-W: DTM Wash Primer B71Y1.
 - 4) Tnemec: Series 27 F. C. Typoxy Polyamide Epoxy.
 - b. Intermediate Coat: Epoxy applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 3.0 to 5.0 mils .
 - 1) Tnemec: Intermediate coat not required.
 - c. Intermediate Coat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils .
 - 1) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
 - 2) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
 - 3) S-W: Corothane II Satin B65W200 Series.
 - 4) Tnemec: Intermediate coat not required.
 - d. Topcoat: Aliphatic polyurethane enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils .
 - 1) Moore: M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
 - 2) PPG: 97-84XX Series Pitthane High Build Acrylic-Aliphatic Urethane Enamel.
 - 3) S-W: Corothane II Satin B65W200 Series.
 - 4) Tnemec: Series 75 Endura-Shield.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
 - 1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
 - 2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.
- B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.
 - 1. If a potential incompatibility of primers applied by others exists, obtain the following from the primer Applicator before proceeding:
 - a. Confirmation of primer's suitability for expected service conditions.
 - b. Confirmation of primer's ability to be top coated with materials specified.
 - 2. Notify Architect about anticipated problems before using the coatings specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - 1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.
- B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
 2. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
 - a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10/NACE No. 2.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
 3. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
 - a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
 2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
 3. Use only the type of thinners approved by manufacturer and only within recommended limits.
- E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply high-performance coatings according to manufacturer's written instructions.
1. Use applicators and techniques best suited for the material being applied.
 2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

3. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
 4. Provide finish coats compatible with primers used.
 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required is the same regardless of application method.
 - a. Omit primer on metal surfaces that have been shop primed and touchup painted.
 - b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 - c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
 - d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
 2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
 - a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.

- b. Brush out and work brush coats into surfaces in an even film.
 - c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
- 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
- 3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
 - a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
 - b. Apply each coat to provide the equivalent hiding of brush-applied coats.
 - c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.
- D. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
 - 1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.
- F. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.4 CLEANING

- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
 - 1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
 - a. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

END OF SECTION 099600

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Dimensional characters.
 - 2. Panel signs.
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Construction Facilities, Utilities and Controls" for temporary Project identification signs and for temporary information and directional signs.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
 - 3. Division 23 Section "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
 - 4. Division 26 Sections for electrical service and connections for illuminated signs.
 - 5. Division 26 Section "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
 - 6. Division 26 Section "Interior Lighting" for illuminated Exit signs.

1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
 - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
 - 1. Aluminum.
 - 2. Acrylic sheet.

- D. Sign Schedule: See schedule at end of this section.
- E. Maintenance Data: For signs to include in maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
- B. Aluminum Sheet and Plate: **ASTM B 209**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- C. Aluminum Extrusions: **ASTM B 221**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
- D. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

2.2 DIMENSIONAL CHARACTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Gemini Incorporated.
 - 2. Metal Arts; Div. of L&H Mfg. Co.
 - 3. Southwell Company (The).
- B. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.
 - 1. Character Material: Aluminum.
 - 2. Thickness: As indicated.
 - 3. Color(s): Custom color to match Architect's sample.
 - 4. Mounting: Post mounted, 2" from masonry face.
 - a. Provide corrosion resistant mounting posts and hardware compatible with substrates indicated.
 - 1) Mounting shall be anchored securely and embedded minimum 2" into masonry substrate. Grout anchors with epoxy grout.
 - b. Provide bituminous coating to prevent galvanic action at points of contact between metal and masonry.
 - 5. Lettering: As selected from manufacturer's standard styles
 - 6. See drawings for location and copy.

2.3 PANEL SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ACE Sign Systems, Inc.
 - 2. APCO Graphics, Inc.
 - 3. Best Sign Systems Inc.
 - 4. Innerface Sign Systems, Inc.
- B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus **1/16 inch** measured diagonally from corner to corner, complying with the following requirements:
 - 1. Acrylic Sheet
 - 2. Edge Condition: Square.
 - 3. Corner Condition: Square.
 - 4. Mounting: Unframed.
 - a. Manufacturer's standard anchors for substrates encountered.
 - 5. Custom Paint Colors: Match Pantone color matching system.
 - 6. Color: As selected by Architect from manufacturer's full range.
 - 7. Tactile Characters: Characters and Grade 2 Braille raised **1/16 inch** above surface with contrasting colors.
 - 8. Text: $\frac{3}{4}$ " Helvetica Medium; upper and lower case; text to be indented $\frac{3}{4}$ " from top and left side.
 - 9. See "Typical Elevation" at end of section.
- C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
 - 1. Raised-Copy Thickness: Not less than **1/16 inch**.
- D. Subsurface Copy: Apply minimum **4-mil-** thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.
- E. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
 - 1. Custom Paint Colors: Match Pantone color matching system.
 - 2. Color: As selected by Architect from manufacturer's full range.
- F. Panel Sign Schedule:
 - 1. Verify schedule with Architect and Owner
 - 2. Provide 8" x 8" raised copy and Braille sign with room name and number. Provide graphics where required by code.
 - 3. Schedule:
 - a. Provide sign with room name and number and graphics at Men's Locker and Women's Locker (two doors each); HC Toilet.
 - b. Provide signs with room name and number only at every interior door.
 - c. Text for signs shall be reviewed by the Owner and Architect in the shop drawings.

2.4 REVERSE PAN CHANNEL SIGNAGE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
 - 1. Basis of Design: Vertical Sign Solutions
- B. Reverse Pan Channel Letter Set with Halo illumination with white LED's to painted steel Backer numbers. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Comply with the following requirements.
 - 1. Character Material: Aluminum.
 - 2. Thickness: As indicated.
 - 3. Color(s): Custom color to match Architect's sample.
 - 4. Mounting: Reverse Pan Channel numbers mounted to Backer numbers on 2" aluminum standoffs. Back numbers mounted to support beam by steel angle as indicated.
 - a. Provide corrosion resistant mounting posts and hardware compatible with substrates indicated.
 - 5. Lettering: As selected from manufacturer's standard styles
 - 6. See drawings for location and copy.

2.5 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.6 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
 - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
 - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
 - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. 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.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.

2.9 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
- C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
 1. Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dimensional characters.
 - a. Cutout dimensional characters.
 - b. Fabricated channel dimensional characters.

1.2 DEFINITIONS

- A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.3 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
1. Include fabrication and installation details and attachments to other work.
 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
 4. Show locations of electrical service connections.
 5. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.
- D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.
- E. Delegated Design Submittal: For signs indicated in "Performance Requirements" Article.

1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Separation or delamination of sheet materials and components.
 2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of dimensional character sign type(s) at canopy and monument sign according to structural performance requirements.

- B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
 - 1. Uniform Wind Load: As indicated on Drawings.
 - 2. Concentrated Horizontal Load: As indicated on Drawings.
 - 3. Other Design Load: As indicated on Drawings.
 - 4. Uniform and concentrated loads need not be assumed to act concurrently.
- C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. Character Material: Cast aluminum.
 - 2. Character Height: As indicated on Drawings.
 - 3. Thickness: As indicated on Drawings; manufacturer's standard for size of character.
 - 4. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - d. Overcoat: Manufacturer's standard baked-on clear coating.
 - 5. Mounting: Projecting studs.
 - 6. Typeface: As indicated on Drawings.
- B. Cutout Characters: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. A.R.K. Ramos.
 - b. ACE Sign Systems, Inc.
 - c. APCO Graphics, Inc.
 - d. ASI Sign Systems, Inc.
 - e. Cosco.

- f. Diskey Architectural Signage Inc.
 - g. Gemini Incorporated.
 - h. Inpro Corporation.
 - i. Matthews International Corporation; Bronze Division.
 - j. Metal Arts.
 - k. Metallic Arts.
 - l. Southwell Company (The).
 - m. Steel Art Company.
- 2. Character Material: Sheet or plate aluminum or stainless steel.
- 3. Character Height: As indicated on Drawings.
- 4. Thickness: As indicated on Drawings.
- 5. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Integral Stainless-Steel Finish: As selected by Architect from full range of industry finishes.
 - d. Integral Acrylic Color: As selected by Architect from full range of industry colors.
 - e. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - f. Overcoat: Manufacturer's standard baked-on clear coating.
- 6. Mounting: Projecting studs.
- 7. Typeface: As indicated on Drawings.
- C. Fabricated Channel Characters: Open face with metal side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. A.R.K. Ramos.
 - b. ACE Sign Systems, Inc.
 - c. Allen Industries Architectural Signage.
 - d. APCO Graphics, Inc.
 - e. ASI Sign Systems, Inc.
 - f. Charleston Industries, Inc.
 - g. Cosco.
 - h. Gemini Incorporated.
 - i. Metallic Arts.
 - j. Signs & Decal Corp.
 - k. Steel Art Company.

2. Illuminated Characters: Backlight character construction with LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
 - a. Power: As indicated on electrical Drawings.
 - b. Weeps: Provide weep holes to drain water at lowest part of exterior characters. Equip weeps with permanent baffles to block light leakage without inhibiting drainage.
3. Character Material: Sheet or plate aluminum or stainless steel.
4. Material Thickness: Manufacturer's standard for size and design of character.
5. Character Height: As indicated on Drawings.
6. Character Depth: As indicated on Drawings.
7. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Integral Stainless-Steel Finish: As selected by Architect from full range of industry finishes.
 - d. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
 - e. Overcoat: Manufacturer's standard baked-on clear coating.
8. Mounting: Manufacturer's standard for size and design of character.
 - a. Hold characters at distance as selected by Architect from wall surface.
9. Typeface: As shown on Drawings.

2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

- E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
 - 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.

6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.
 2. Stainless-Steel Brackets: Factory finish brackets to match sign background finish unless otherwise indicated.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.8 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

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. Public-use toilet accessories.
 - 2. Bunk Room toilet / shower room accessories.
 - 3. Custodial accessories.

- B. Related Sections:

- 1. Section 088300 "Mirrors" for frameless mirrors.
 - 2. Section 093000 "Tiling" for ceramic toilet and bath accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:

- 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.

- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

- 1. Approved full-size Samples will be returned and may be used in the Work.

- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

- 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PRODUCTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.

2.3 PUBLIC-USE WASHROOM, SHOWER ROOM, AND CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Wall Mounted Toilet Tissue (Roll) Dispenser, TA-01:
 - 1. Basis of Design: Bobrick Model Number B-3888, or approved equal
 - 2. Description: Double Roll Toilet Tissue Dispenser
 - 3. Mounting: Recessed.
 - 4. Operation: Noncontrol delivery with standard spindle.
 - 5. Capacity: Designed for 5 1/8-inch- diameter tissue rolls.
 - 6. Material and Finish: Stainless steel, Type 304 satin finish.
- C. Soap Dispenser, TA-02, TA-10
 - 1. Basis of Design: Bobrick Model Number B-2013, or approved equal
 - 2. Capacity: 27 fl oz
 - 3. Material and Finish: Stainless Steel
- D. Framed Mirror, TA-03:
 - 1. Basis of Design: Bobrick Model Number B-165, or approved equal
 - 2. Frame: Stainless-steel channel
 - 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

- a. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 4. Size: 24"x36" or as indicated in drawings.
- E. Paper Towel Dispenser/Waste Receptacle, TA-05 – Bunk Rooms
 1. Basis of Design: Bobrick Model Number B-369, or approved equal
 2. Description: Classic Series
 3. Size 12 5/8"W x 26 5/8"H x 4" D
 4. Waste Capacity: 2 Gallons
- F. Paper Towel Dispenser/Waste Receptacle, TA-05 – Public Toilet Rooms 101 and 103.
 1. Basis of Design: Bobrick Model Number B-3803, or approved equal
 2. Description: Trimline Series
 3. Size 11 1/2"W x 53 5/8"H x 5 3/4" D
 4. Waste Capacity: 6.3 Gallons
 - 5.
- G. Grab Bars, TA-06, TA-11, TA-12:
 1. Basis-of-Design Product: Bobrick; B-6806.99, or approved equal
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 4. Outside Diameter: 1-1/4 inches.
 5. Configuration and Length: As indicated on Drawings
- H. Towel Hook, TA-07:
 1. Basis-of-Design Product: Bobrick B-677, or approved equal
 2. Finish: No. 4 (satin)
- I. Baby Changing Station, TA-08:
 1. Basis-of-Design Product: Bobrick; KB300, or approved equal
 2. Mounting: Flanges with concealed fasteners.
 3. Material: Stainless steel, 0.05 inch thick.
 - a. Exterior Finish: Grey 01
 - b. Interior: Grey, polyethylene.
 4. Configuration and Size: Fold-down; 35 1/2" x 20 1/2" x 4"
- J. Shower Rod & Curtain, TA-09:
 1. Shower Rod:
 - a. Basis-of-Design Product: Bobrick; B-207, or approved equal
 - b. Description: 1-inch OD; fabricated from nominal 0.0375-inch- thick stainless steel.
 - c. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
 - d. Finish: No. 4 (satin).
 2. Shower Curtain:
 - a. Basis-of-Design Product: Bobrick "204-2" , or approved equal
 - b. Size: Minimum 6 inches wider than opening by 72 inches high.

- c. Material: Vinyl, minimum 0.006-inch- thick, opaque, matte.
- d. Color: White.
- e. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
- f. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

K. Mop and Broom Holder, adjacent to janitor sinks:

- 1. Basis-of-Design Product: Bobrick; B224x36, or approved equal
- 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
- 3. Length: 36 inches.
- 4. Hooks: Three.
- 5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
- 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

L. Folding Shower Seat, For locating blocking:

- 1. Basis-of-Design Product: Norix Model ISS-200, or approved equal
- 2. Configuration: L-shaped seat, designed for wheelchair access.
- 3. Seat: Stainless Steel recessed flush.
- 4. Mounting Mechanism: Stainless steel, No. 4 finish (satin)

M. Wheeled Trash Can Cart:

- 1. Basis of Design: Toter Model #025548-01GRS, or approved equal
- 2. Size: 48 gallons.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following or approved equal:

- 1. Plumberex Specialty Products, Inc.
- 2. Truebro by IPS Corporation.

B. Underlavatory Guard:

- 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
- 2. Material and Finish: Antimicrobial, molded plastic, white.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

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. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.

- B. Related Sections:

- 1. Section 099113 "Exterior Painting" for field painting fire protection cabinets.
 - 2. Section 099123 "Interior Painting" for field painting fire protection cabinets.
 - 3. Section 101400 "Signage" for directional signage to out-of-sight fire extinguishers and cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of fire protection cabinet indicated.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Size: 6 by 6 inches square.
- E. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.6 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.7 SEQUENCING

- A. Apply decals on field-painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Tempered Break Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, provide the following:
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group;.
 - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;.
 - c. Larsen's Manufacturing Company;.
 - d. Modern Metal Products, Division of Technico Inc.;.
- B. Cabinet Construction: 1-hour fire rated.
 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
- E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 1. Square-Edge Trim: 1-1/4 to 1-1/2-inch backbend depth.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Stainless-steel sheet.
- H. Door Style: Center glass panel with frame.
- I. Door Glazing: Tempered float glass (clear).
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 1. Provide projecting lever handle with cam-action latch.
 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.

L. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet.
2. Steel: Baked enamel or powder coat.
3. Stainless Steel: No. 2B.

2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
 3. Prepare doors and frames to receive locks.
 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning".
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.6 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers.
- B. Related Sections:
 - 1. Division 10 Section "Fire Extinguisher Cabinets."
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for hose systems, racks, and valves.
 - 3. Division 23 Section "Commercial-Kitchen Hoods" for fire extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated; Tyco International Ltd.
 - b. Badger Fire Protection; a Kidde company.
 - c. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - d. Pyro-Chem; Tyco Safety Products.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
- B. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 3-A:40-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10523

SECTION 105113 - METAL LOCKERS

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. Heavy-duty metal lockers.
 - 2. Personal protective equipment lockers

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of metal locker.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- D. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.
- E. Product Schedule: For lockers.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
 - a. Locks.
 - b. Identification plates.
 - c. Hooks.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.
- B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.

3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: For lockers indicated to be accessible, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

2.3 STANDARD METAL LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following or an approved equal:
 1. DeBourgh All American Lockers, First Responder Personnel Lockers
- B. Locker Arrangement: See Drawings.
 1. 73" Locker with boot drawer and standard height handle and latch
- C. Sizes:
 1. 24" x 24" x 73". See Drawings for locations.
- D. Material: Cold-rolled steel sheet.
- E. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
 1. Tops, Bottoms, and Sides: 18 gauge.
 2. Backs: 18 gauge.
 3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back. Shelves shall be adjustable type.
- F. Doors: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 2. Door Style:
 - a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.

- G. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
 - 1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
- H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
 - 1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic latching and prelocking.
 - a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
 - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- I. Design for padlocks by owner.
- J. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
 - 1. Coat Rod
 - 2. Coat Hooks
 - 3. Boot drawer below locker
 - 4. Lockable security drawer
- K. Accessories:
 - 1. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
 - 2. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
 - 3. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
 - 4. Sloped top
- L. Finish: powder coat.
 - 1. Color(s): Selected manufacturer shall provide custom color as required to match architect's sample.

2.4 GEAR LOCKERS

- A. Products: Subject to compliance with requirements, provide the following or approved equal:

1. Mid-Minnesota Wire (GearGrid Product Line).
 - B. Model: Wall Mount Lockers (with offset brackets and floor supports). And Free Standing Tube Wall Structure for floor mounted lockers where indicated on Drawings
 - C. Locker.
 1. Size:
 - a. Overall dimension-74-1/2" high x 30" wide x 24" deep.
 - D. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.
 - E. Vertical Dividers:
 1. Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
 2. Inner Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
 - F. Back Panel:
 1. Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
 - G. Shelves: (1) Top, (1) Bottom. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Top shelf includes a 20 gauge steel bracket to accept a 2" x 16" name placard.
 - H. Apparel Hooks: (3) per opening. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed
 - I. Color(s): As selected by Architect from manufacturer's full line.
 - J. No doors.
- 2.5 FABRICATION
- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
 - B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

- C. Equipment: Provide each locker with an identification plate and the following equipment:
 - 1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
 - 2. Coat Rods.
- D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- E. Accessible Lockers: Fabricate as follows:
 - 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
 - 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- F. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
 - 1. Sloping-top corner fillers, mitered.
- H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

2.6 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
 - 3. Anchor back-to-back metal lockers to floor.
- B. Welded Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - b. Attach plates to upper shelf of each open-front metal locker, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 - 1. Attach recess trim to recessed metal lockers with concealed clips.
 - 2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 - 3. Attach sloping-top units to metal lockers, with closures at exposed ends.
 - 4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

- E. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 105240 -KEY STORAGE CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Data and key storage cabinet for fire/police rapid entry.

1.02 ACTION SUBMITTALS

A. Product Data:

1. Product Data and manufacturers standard installation methods and details.

B. Shop Drawings:

1. Include methods of installation differing from manufacturer's standard details. Indicate dimensions, clearances, and depth of recess.

1.04 QUALITY ASSURANCE

- ##### A.
- Provide cabinets and accessories produced by a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- ##### A.
- Deliver, store, and protect defibrillator cabinets and related materials using means and methods that will prevent damage, deterioration, or loss.
 1. Deliver components in manufacturer's original packaging, properly labeled for identification.

PART 2 - PRODUCTS

2.01 STORAGE CABINET

- ##### A.
- Provide Knox Company "Knox Box", MODEL SERIES 3200 Data Storage Cabinet and Key Cabinet. Models #3270 (dining room) and #3290 (exterior masonry recessed), or approved equal.
 - B. Exterior Dimensions: Surface Mount Body – 4" H x 5" W x 3-7/8" D Recessed Mount Flange 7"H x 7" W
 - C. Color: Black
 - D. Lock: UL Listed Double-action rotating tumblers and hardened steel pins accessed by a biased cut key. GC to coordinate order with City FM for keying

PART 3 - EXECUTION

3.01 INSTALLATION

- ##### A.
- Install in accordance with manufacturer's instruction, recessed where possible.

END OF SECTION

SECTION 105600 – SLIDING POLES

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. Automatic Sliding Pole with Automatic Operating Fire Shutters (where indicated on drawings).

1.3 PRODUCTS

- A. TYPICAL SLIDE POLE ASSEMBLY (RATED FLOOR / CEILING ASSEMBLIES); (Quantity: 2)
 - 1. Basis of Design: Slide Pole Model 23 as furnished and installed by McIntire Brass Works, Inc. or approved equal.
 - 2. Required Components where indicated on drawings.
 - a. Complete automatic operating fire resistance doors, motors, controller and sliding pole unit with safety gate.
 - b. Gap sealing with intumescent materials to ensure sealing in case of fire.
 - c. The unit must be connected to 120V AC on a separate fuse of 15 AMPS.
 - d. Heat sensor to shut unit operation down in case of fire.
 - e. Self-closing gate.
 - f. Two infrared sensors.
 - g. Polished brass pole, 2-1/2" diameter 5/32" cold drawn brass tubing

1.4 INSTALLATION

- A. Install per manufacturer's instructions.
- B. Maintain manufacturer's minimum clearance distances from the center of the sliding pole to any wall or obstruction as follows: 25" on cage floor and 30" on the ceiling below and downward.
- C. Frame hole in floor to suit equipment. All equipment shall be installed in strict accordance with the manufacturer's details. Pole shall be secured to structure above.

PART 2 - EXECUTION (Not Used)

END OF SECTION 105600

SECTION 105613 - METAL STORAGE SHELVING

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. Four-post metal storage shelving.
- B. Related Sections:

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design metal storage shelving, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance for Four-Post Metal Storage Shelving: Capable of withstanding the loads indicated according to MH 28.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.
- B. Shop Drawings: For customized metal storage shelving. Include plans, elevations, sections, details, and attachments to other work. Include installation details of connectors, lateral bracing, and special bracing.
- C. Samples for Verification: For the following components, of size indicated below:
 - 1. Vertical End Panels: 12 inches (305 mm) tall.
 - 2. Shelves: Full size, but not more than 24 inches wide by 18 inches deep (610 mm wide by 305 mm deep).
 - 3. Connectors for Shelf to Post: Full size.
- D. Product Schedule: For metal storage shelving.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of metal storage shelving from manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal storage shelving to include in maintenance manuals.

1.7 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Shelves: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than five shelves.
 - 2. Shelf-to-Post Connectors: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 connectors.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain metal storage shelving from single source from single manufacturer.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate sizes and locations of blocking and backing required for installation of metal storage shelving attached to wall and ceiling assemblies.
- B. Coordinate locations and installation of metal storage shelving that may interfere with ceiling systems including lighting, HVAC, speakers, sprinklers, access panels, electrical switches or outlets, and floor drains.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Available manufacturers subject to requirements of this section include but are not limited to the following:
 - 1. Penco
 - 2. Lyon
 - 3. Republic
- B. Intermediate shelving units shall have open sides with solid metal reinforced shelves; provide double cross bracing not less than 12 gauge on the back of each unit for freestanding units; all wall units shall be anchored to wall.
- C. Standard Shelving units shall support minimum of 50 lbs. per square foot of total shelf area. Provide seven (7) shelves per unit. Shelf shall be box formed. Front and rear flange shall utilize box beam construction. Flanges shall be welded on not less than 3" centers. Corners shall be lapped and welded. Sides shall be double flanged, not less than 22 gauge.
- D. All shelves shall be adjustable, utilizing compression type clip of not less than 14 gauge (no bolts).
- E. Provide and install solid end panels of not less than 24 gauge at the end of each run of units.
- F. All posts shall be angle post type, not less than 14 gauge, punched on 1" or 1 1/2" centers.
- G. Colors shall be selected from manufacturer's standard colors.

2.2 FABRICATION

- A. Shelving units shall be thoroughly degreased with phosphate coating and dipped in chromic acid rinse for resistance to corrosion. Final coat shall be baked-on enamel.

2.3 HOSE STORAGE RACK

- A. Manufacturers: Provide Ready Rack Mobile Hose Cart – 72" 3 Tier or approved equal.
- B. Dimensions: 72"L x 34"W x 87"H
- C. Color: Red

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where metal storage shelving will be installed.
- C. Examine walls and ceilings to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Vacuum finished floor and wet mop resilient flooring over which metal storage shelving is to be installed.

3.3 INSTALLATION

- A. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.
 - 1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.
 - 3. Adjust post-base bolt leveler to achieve level and plumb installation.
 - 4. Anchor shelving units to floor with floor anchors through floor plate. Shim floor plate to achieve level and plumb installation.
 - 5. Install seismic restraints.
 - 6. Connect side-to-side and back-to-back shelving units together.
 - 7. Install shelves in each shelving unit at spacing indicated on Drawings or, if not indicated, at equal spacing.
 - a. Four-Post Metal Storage Shelving: Install four clips, one at each post, for support of each shelf; with clips fully engaged in post perforations.
- B. Accessories:
 - 1. Install finished end panels and trim at exposed ends of shelving units.

3.4 ADJUSTING

- A. Adjust metal storage shelving so that connectors and other components engage accurately and securely.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Adjust and lubricate operable components to operate smoothly and easily, without binding or warping. Check and readjust operating hardware.
- C. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.
- D. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 105613

SECTION 107313 - AWNINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Fixed awnings.
- B. Related Requirements:
 - 1. Section 076200 "Sheet Metal Flashing and Trim" for exposed metal flashing and miscellaneous sheet metal trim and accessories.
 - 2. Section 079200 "Joint Sealants" for penetrations through building envelope.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for awnings.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, mounting heights, and attachment details.
 - 2. Show locations for blocking, reinforcement, and supplementary structural support.
- C. Samples for Initial Selection: For each type of exposed finish.
- D. Product Schedule: For awnings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For awnings to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 WARRANTY

- A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of awnings that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Awning Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 AWNING FRAME AND ACCESSORY MATERIALS

- A. Aluminum: Alloy and temper recommended by awning manufacturer for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
 - 1. Aluminum Plate and Sheet: ASTM B209.
 - 2. Aluminum Extrusions: ASTM B221.
 - 3. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, standard weight (Schedule 40).
 - 4. Drawn Seamless Tubing: ASTM B210.
- B. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, compatible, nonstaining materials. Provide as required for awning assembly, mounting, and secure attachment. Number as needed to comply with performance

requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

1. Wood Screws: ASME B18.6.1.
 2. Lag Bolts: ASME B18.2.1.
 3. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers, zinc coated.
 4. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.3 FIXED AWNINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Mapes Architectural Canopies, Cantilever Bracket Support.
 2. Frame Fabrication: Fabricate awning frames from aluminum. Preassemble in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
 3. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
 4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip-fit connections exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
 5. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended, so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 6. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure awnings in place and to properly transfer loads.

- B. Aluminum Finish: Baked-enamel or powder-coat finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
 - 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, 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. General: Install awnings at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
- B. Install awnings after other finishing operations, including joint sealing and painting, have been completed.
- C. Slip fit frame connections accurately together to form hairline joints, and tighten to secure.
- D. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 1. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing awnings to structural support and for properly transferring load to in-place construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- G. Coordinate awning installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed exterior wall and roof assemblies.

3.3 CLEANING AND PROTECTION

- A. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 107313

SECTION 107500 - FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ground-mounted flagpoles.
2. Mounting accessories.

1.2 REFERENCE STANDARDS

A. American Architectural Manufacturers Association:

1. AAMA 611 - Voluntary Specification for Anodized Aluminum.
2. AAMA 2604 - Voluntary Specification, Performance Requirements, and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A312/A312M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
6. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles. Include plans, elevations, details, and attachments to other work. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
1. Include section, and details of foundation system for ground-mounted flagpoles.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- E. Qualifications Statements:
 - 1. Submit qualifications for manufacturer, installer, and licensed professional.
 - 2. Submit manufacturer's approval of installer.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flagpole as complete unit, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Shipping: Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Inspection: Accept materials on site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.7 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

1.8 WARRANTY

- A. Furnish lifetime manufacturer's warranty for flagpole.

- B. Furnish 5-year manufacturer's warranty for flagpole accessories and finish.

PART 2 - PRODUCTS

2.1 FLAGPOLES

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acme/Lingo Flagpoles, LLC.
 - b. American Flagpole
 - c. Atlantic Fiberglass Products, Inc.
 - d. Baartol Company.
 - e. Concord Industries, Inc.
 - f. Eder Flag Manufacturing Company, Inc.
 - g. Ewing Flagpoles.
 - h. Millerbernd Manufacturing Company.
 - i. Morgan-Francis Flagpoles and Accessories.
 - j. PLP Composite Technologies, Inc.
 - k. Pole-Tech Company Inc.
 - l. U.S. Flag & Flagpole Supply, LP.
 - m. USS Manufacturing Inc.

B. Description:

1. Flagpole Construction, General: Construct flagpoles in 1 piece if possible. If more than 1 piece is necessary, comply with the following:
 - a. Fabricate shop and field joints without using fasteners, screw collars, or lead caulking.
 - b. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
 - c. Provide self-aligning, snug-fitting joints.
2. Exposed Height: 20 feet.
3. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B241/B241M, Alloy 6063, with a minimum wall thickness of 3/16-inch.
4. Metal Foundation Tube: Manufacturer's standard corrugated-steel foundation tube, not less than 0.064-inch nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel ground spike; and steel centering wedges welded together. Galvanize steel after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
 - a. Provide flashing collar of same material and finish as flagpole.

2.2 FITTINGS

- A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
 - 1. 0.063-inch spun aluminum, finished to match flagpole.
- B. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16-inch-diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
 - 1. Provide 1 halyard and 1 cleat at each flagpole.
 - 2. Halyard Flag Snaps: Provide 2 chromium-plated bronze, stainless-steel, bronze, or nylon swivel snap hooks per halyard.
 - a. Provide with neoprene or vinyl covers.
 - 3. Plastic Halyard Flag Clips: Made from injection-molded, UV-stabilized, acetal resin (Delrin). Clips attach to flag and have 2 eyes for inserting both runs of halyards. Provide 2 flag clips per halyard.
 - a. Product: Subject to compliance with requirements, provide "Quiet Halyard" flag clasp by Lingo.

2.3 MISCELLANEOUS MATERIALS

- A. Drainage Material: Crushed stone or crushed or uncrushed gravel; coarse aggregate.
- B. Sand: ASTM C 33, fine aggregate.
- C. Elastomeric Joint Sealant: Single component nonsag urethane joint sealant complying with requirements in Section 079200 "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, for Use O.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.4 GENEREAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

- A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including foundation; accurate placement, pattern, orientation of anchor bolts, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coat metal sleeve surfaces below-grade with a heavy coat of bituminous paint where in contact with cementitious surfaces, or where in contact with dissimilar metals.

3.3 INSTALLATION

- A. Electrically ground flagpole installation.
- B. Assemble flagpole components and accessories according to manufacturer instructions.
- C. Fill foundation tube sleeve with sand as specified in Section 033000 "Cast-in-Place Concrete" and compact.
- D. Flagpoles Set in Concrete Base: Install welded base assembly and fasten.
- E. Locate electric control box where indicated on Drawings.
- F. Coordinate installation of conduit and boxes from disconnect to control unit and from control unit to motor-operating device.

3.4 ADJUSTING

- A. Adjust operating devices such that halyard, winch, controls, and flag function smoothly.

END OF SECTION 107500

SECTION 113100 - RESIDENTIAL APPLIANCES

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. Cooking appliances.
 - 2. Kitchen exhaust ventilation.
 - 3. Refrigeration appliances.
 - 4. Cleaning appliances.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.
- B. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- C. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Certificates: For each type of appliance, from manufacturer.
- C. Field quality-control reports.
- D. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintains, within 30 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

- B. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- C. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.
- D. Regulatory Requirements: Comply with the following:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
- E. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, and ICC/ANSI A117.1.
- F. Preinstallation Conference: Conduct conference at Project site.

1.7 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Electric Full warranty including parts and labor for on-site service on surface-burner elements.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Microwave Oven: Full warranty including parts and labor for on-site service on the magnetron tube.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- D. Refrigerator/Freezer, Sealed System: Full warranty including parts and labor for on-site service on the product.
 - 1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
 - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.
- E. Dishwasher: Full warranty including parts and labor for on-site service on the product.
 - 1. Warranty Period for Deterioration of Tub and Metal Door Liner: Five years from date of Substantial Completion.
 - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.
- F. Clothes Washer: Full warranty including parts and labor for on-site service on the product.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COOKING APPLIANCES

A. Gas Range:

1. Basis-of-Design Product: Viking 36" VGCC536, gas cooktop, or approved equal.
2. Width: 36 inches.
3. Gas Burners: Six.
 - a. Power Ratings: Manufacturer's standard.
 - b. Grates: Individual.
4. Ovens: One
5. Other Feature(s):
 - a. Stainless Steel backsplash from range to hood.
 - b. High shelf for range.
6. Finishes:
 - a. Stainless steel.
 - b. Black porcelain grates
7. Anti-Tip Device: Manufacturer's standard.
8. Electric Power Supply: As indicated on Drawings.

2.2 ICEMAKERS

A. Icemaker (Freestanding):

1. Basis-of-Design Product: Manitowac: iYT0300A with D-400 Bin or approved equal.
2. Type: Freestanding.
3. Ice Capacity:
 - a. Production: 310 lbs. per 24-hour day.
 - b. Storage: 365 lbs.
4. Features:
 - a. Automatic shutoff.
 - b. Defrost drain.
 - c. Water filter.
 - d. Front air intake and exhaust.
 - e. Computerized control.
5. Appliance Color/Finish: Stainless steel.
6. Electrical Service: Equip unit for connection to service indicated on Drawings.

2.3 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods, and microwave ovens with vented exhaust fans will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.
- E. Utilities: Comply with plumbing and electrical requirements.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. An appliance will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113100

SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with blackout shades (at exterior windows where indicated on drawings)
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
 - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark inside face of material if applicable.
 - 2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
 - 3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.
- E. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Bead Chains: Stainless steel.
 - a. Loop Length: As required to operate full height of window shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Locking-style chain retainer restricts the operation of the chain unless the chain retainer is properly mounted to a fixed surface such as a window frame, sill, or wall. Compliant with American National Standard for Safety of Corded Window Covering Products ANSI A100.1. Non-locking P-Clip is not acceptable.
 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Spring Operating Mechanisms: Roller contains spring sized to accommodate shade size indicated. Provide with positive locking mechanism that can stop shade movement at each half-turn of roller and with manufacturer's standard pull.
1. Pole: Manufacturer's standard type in length required to make operation convenient from floor level and with hook for engaging pull.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
1. Roller Drive-End Location: Right side of inside face of shade.
 2. Direction of Shadeband Roll: Reverse, from front of roller.
 3. Shadeband-to-Roller Attachment: Removable spline fitting integral channel in tube.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 4 inches (102 mm).
2. Endcap Covers: To cover exposed endcaps.
3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: 2 inches (51 mm).
4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
5. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Black-out Shade Fabric: Woven fabric, stain and fade resistant.
 1. Source: Roller-shade manufacturer.
 2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
 3. Weave: Basketweave.
 4. Roll Width: 118 inches (2997 mm).
 5. Orientation on Shadeband: Up the bolt.
 6. Openness Factor: 0 percent.
 7. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
 - 2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 - 2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
 - 3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches (51 mm) to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661 - SIMULATED STONE COUNTERTOPS

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. Solid-surface-material countertops and backsplashes.
 - 2. Quartz agglomerate countertops and backsplashes.

- B. Related Sections:

- 1. Section 123640 "Stone Countertops."
 - 2. Section 224100 "Residential Plumbing Fixtures" for nonintegral sinks, sinks, and plumbing fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Initial Selection: For each type of material exposed to view.
- D. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches (150 mm) square.
 - 2. One full-size solid-surface-material countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.
 - 3. One full-size quartz agglomerate countertop, with front edge and backsplash, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: 1/8-inch eased edge.
 - 2. Backsplash: Radius edge with 1/8-inch (9.5-mm) radius.
 - 3. Endsplash: Matching backsplash.
- B. Countertops: 3/4-inch-(19-mm-) thick, solid surface material with front edge built up with same material.
- C. Backsplashes: 1/2-inch-(12.7-mm-) thick, solid surface material
- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
 - 2. Install integral sink bowls in countertops in the shop.

2.2 QUARTZ AGGLOMERATE COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: 1/8-inch eased edge.
 - 2. Backsplash: Radius edge with 1/8-inch (9.5-mm) radius.
 - 3. Endsplash: Matching backsplash.
- B. Countertops: 3/4-inch-(19-mm-) thick, quartz agglomerate with front edge built up with same material.
- C. Backsplashes: 3/4-inch-(19-mm-) thick, quartz agglomerate.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.

2.3 COUNTERTOP MATERIALS

- A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- B. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS-1.
 - 1. Type: Provide Standard Type unless Special Purpose Type is indicated.
 - 2. Integral Sink Bowls: Comply with ISSFA-2 and ANSI Z124.3, Type 5 or Type 6, without a precoated finish.
 - 3. Colors and Patterns: Corian Solid Surface, White Onyx. (Toilet rooms)
- C. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.
 - 1. Colors and Patterns: Corian quartz, Concrete Carrara. (Kitchen)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 1. Install backsplashes and endsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 2. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient entrance mats.
 - 2. Recessed frames.
- B. Related Requirements:
 - 1. Section 124816 "Entrance Floor Grilles" for rigid floor grilles and frames.

1.3 COORDINATION

- A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.
- B. Shop Drawings:
 - 1. Items penetrating floor mats and frames, including door control devices.
 - 2. Divisions between mat sections.
 - 3. Perimeter floor moldings.
 - 4. Custom Graphics: Scale drawing indicating colors.
- C. Samples: For the following products, in manufacturer's standard sizes:
 - 1. Floor Mat: Assembled sections of floor mat.
 - 2. Tread Rail: Sample of each type and color.
 - 3. Frame Members: Sample of each type and color.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

- A. Regulatory Requirements: Comply with applicable provisions in, ICC A117.1.

2.2 RESILIENT ENTRANCE MATS

- A. Basis of Design: C/S Group Pedimat Series
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Floor Products Company, Inc.
 - 2. Balco, Inc.
 - 3. Mats, Inc.
- C. Carpet-Type Mats: Nylon carpet bonded to 1/8- to 1/4-inch-(3.2- to 6.4-mm-)thick, flexible vinyl backing to form mats 3/8 or 7/16 inch (9.5 or 11 mm) thick with nonraveling edges.
 - 1. Colors, Textures, and Patterns: Selected from manufacturer's full range.
 - 2. Mat Size: As indicated.

2.3 FRAMES

- A. Recessed Frames: Manufacturer's standard extrusion.
 - 1. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
 - a. Color: Clear.

2.4 FABRICATION

- A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

- B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

2.5 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
 - 1. For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.
 - 2. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
 - 3. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
- B. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.
 - 1. Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

3.3 PROTECTION

- A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

SECTION 142600 - LIMITED-USE/LIMITED-APPLICATION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Limited-use/limited-application elevators.

1.2 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to Work of this Section.
- B. LU/LA: Limited use/limited application.

1.3 ACTION SUBMITTALS

- A. Product Data: Limited-use/limited-application elevators.
- B. Product Data Submittals: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal equipment.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Indicate loads imposed on building structure at points of support and power requirements.
- D. Samples for Initial Selection: For finishes involving color selection.
- E. Samples for Verification: For exposed car finishes, hoistway doors, and frames; 3-inch-square Samples.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchoring provisions.

3. Detailed description of equipment anchoring devices on which the certification is based and their installation requirements.
- C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as indicated on Drawings, and electrical service, as indicated and specified, are adequate for elevator being provided.
- D. Preinstallation Examination Report: Indicating dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
- E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 1. Submit manufacturer's/installer's standard operation and maintenance manual, according to ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction, for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard 5-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.8 COORDINATION

- A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

- B. Coordinate locations and dimensions of other work relating to LU/LA elevators including sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.9 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIMITED-USE/LIMITED-APPLICATION ELEVATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by 1 of the following:
 - 1. American Crescent Elevator Mfg., Corp.
 - 2. Federal Elevator.
 - 3. Liftavator, Inc.
 - 4. Nationwide Lifts, Inc.
 - 5. Savaria; Basis of Design: Orion; Type 1R Standard Cab.
 - 6. Schumacher Elevator Co.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with requirements for LU/LA elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.3 SYSTEMS AND COMPONENTS

- A. Elevator System, General: Manufacturer's standard LU/LA elevator. Unless otherwise indicated, manufacturers' standard components are to be used, as included in standard LU/LA elevators and as required for complete system.
 - 1. Rated Load: 1,400 lbs.

2. Rated Speed: 25 to 30 fpm.
- B. Machine Type: Hydraulic, holeless, beside the car; direct-acting hydraulic or roped hydraulic.
- C. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
 1. Pump to be submersible type, suspended inside oil tank from vibration isolation mounts.
 2. Motor to have solid-state starting.
 3. System to have hydraulic silencer and flexible piping connectors at pump unit.
- D. Hydraulic Fluid: Elevator manufacturer's standard fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.
- E. Inserts: Furnish required concrete and masonry inserts and similar anchoring devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

2.4 OPERATION SYSTEMS

- A. Provide manufacturer's standard operation system for automatic operation.
- B. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put into service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.
- C. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its car and hoistway doors, and shuts down. System includes rechargeable battery and automatic recharging system.
- D. Provide automatic operation of lights and ventilation fans.
- E. Key Switch Operation: Push buttons are activated and deactivated by security key switch. Key is removable in either position.

2.5 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door-reopening devices with a uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of 1 or more light beams causes doors to stop and reopen.

2.6 CAR ENCLOSURES

- A. Provide steel-framed car enclosures with wall panels, car roof, access doors, power door operators, and ventilation. Provide finished car including materials and finishes specified below.

B. Clear Inside Dimensions:

1. Inside Width: 42 inches from sidewall to sidewall.
2. Inside Depth: 54 inches from back wall to front wall (return panels).
3. Inside Height: 84 inches to underside of ceiling.

C. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Floor Finish: Elevator manufacturer's standard level-loop nylon carpet; color as selected by Architect from manufacturer's full range.
2. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to manufacturer's standard core with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels to have a flame-spread index of 75 or less, when tested in accordance with ASTM E84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
3. Sills: Extruded or machined aluminum, with grooved surface, 1/4-inch thick.
4. Metal Ceiling: Flush panels, fabricated from cold-rolled steel sheet. Provide panels with factory-applied enamel or powder-coat finish; colors as selected by Architect from manufacturer's full range.
5. Lighting: Not less than 2 downlights. Provide battery backup power source with automatic charging.
 - a. Light Fixture Efficiency: Not less than 35 lumens/watt.
6. Handrail: Manufacturer's standard.

D. Car Doors: Manufacturer's standard units complete with track systems, hardware, sills, and accessories.

1. Operation: Power-operated, automatic.
2. Type: Horizontal sliding.
3. Clear Opening Width: 36 inches.
4. Door Height: 80 inches.
5. Aluminum Folding Doors: Aluminum extrusions with edges forming full-height hinges connected by stainless steel rod.

2.7 HOISTWAY ENTRANCES

A. Provide manufacturer's standard door-and-frame hoistway entrances, same size as car doors, complete with track systems, hardware, sills, and accessories.

1. Operation: Power-operated, automatic.
2. Type: Horizontal sliding.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies to comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as-close-to-neutral pressure as possible according to NFPA 252.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 degrees F.

2.8 SIGNAL EQUIPMENT

- A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with light-emitting diodes.
 1. Finish: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
- B. Car-Control Stations: Provide manufacturer's standard car-control stations. Mount in side panel adjacent to car door unless otherwise indicated.
 1. Mark buttons and switches for function. Use both tactile symbols and Braille.
 2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Car Position Indicator: Provide digital-type position indicator in elevator car. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- E. Hall Push-Button Stations: Wall-mounted or jamb-mounted units equipped with buttons for calling elevator and for indicating desired direction of travel where applicable.
- F. Hall Lanterns: Wall-mounted or jamb-mounted units with illuminated arrows; but provide single arrow at terminal landings.
- G. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 1. At manufacturer's option, audible signals may be placed on car.
- H. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.9 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.
- D. Stainless Steel Bars: ASTM A276/A276M, Type 304.
- E. Stainless Steel Tubing: ASTM A554, Grade MT 304.
- F. Aluminum Extrusions: ASTM B221, Alloy 6063.
- G. Plastic Laminate: High-pressure type complying with ISO 4586-3, Type HGS for flat applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LIMITED-USE/LIMITED-APPLICATION ELEVATORS

- A. Install cylinder plumb and accurately located for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- B. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise from elevator system.
- C. Lubricate operating parts of systems as recommended by manufacturers.
- D. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Reduce clearances to minimum, safe, workable dimension at each landing.
- E. Leveling Tolerance: 1/4-inch, up or down, regardless of load and direction of travel.
- F. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

- G. Locate hall lanterns either above or beside hoistway entrance at a minimum of 72 inches above finished floor unless hall lanterns are built into entrance frames.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use, perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by authorities having jurisdiction.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance during normal working hours.
 - 2. Perform emergency callback service during normal working hours with response time of 2 hours or less.
 - 3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of 2 hours or less.

END OF SECTION 142600

**SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Above ground piping.
- B. Buried piping.
- C. Escutcheons.
- D. Expansions - hose and braid.
- E. Fire rated enclosures.
- F. Mechanical couplings.
- G. Pipe hangers and supports.
- H. Pipe sleeves.
- I. Pipe sleeve-seal systems.
- J. Retrofit - sprinkler piping cover system.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 099113 - Exterior Painting: Preparation and painting of exterior fire protection piping systems.
- C. Section 099123 - Interior Painting: Preparation and painting of interior fire protection piping systems.
- D. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- E. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- F. Section 210716 - Fire Suppression Equipment Insulation: Insulation of fire suppression equipment piping, fittings, valves, mechanical couplings, connections, hangers, insulation inserts, shields, etc.
- G. Section 211200 - Fire-Suppression Standpipes: Standpipe design.
- H. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2021.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.
- G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings 2018.
- H. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded 2016, with Errata (2017).

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- I. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- J. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- K. ASME B16.25 - Buttwelding Ends 2017.
- L. ASME B36.10M - Welded and Seamless Wrought Steel Pipe 2018.
- M. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- N. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- O. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2021.
- P. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- Q. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- R. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).
- S. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use 2021.
- T. ASTM B32 - Standard Specification for Solder Metal 2020.
- U. ASTM B75/B75M - Standard Specification for Seamless Copper Tube 2020.
- V. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- W. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- X. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
- Y. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- Z. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- AA. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.
- BB. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2019.
- CC. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2020.
- DD. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2020.
- EE. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- FF. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- GG. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- HH. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2021.
- II. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- JJ. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).

KK. AWWA C606 - Grooved and Shouldered Joints 2015.

LL. FM (AG) - FM Approval Guide current edition.

MM. ITS (DIR) - Directory of Listed Products Current Edition.

NN. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

OO. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2019, with Amendment.

PP. UL (DIR) - Online Certifications Directory Current Edition.

QQ. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop drawings shall be submitted as specified in Division 1. Product data shall be submitted for all materials and equipment specified in DIVISION 21. Shop drawings and submittals must be submitted in PDF format and emailed to the design team.
- C. Shop drawing submittals shall include the following for each piece of equipment and material, as applicable:
 - 1. Product data listing manufacturer, model number, materials, and miscellaneous data as required to describe the equipment.
 - 2. Capacity, pressure drop, rpm, motor horsepower, and other miscellaneous data to quantify the size of the equipment.
 - 3. Dimensional drawings showing layout, connection points, and detailed layout of components.
 - 4. Electrical full load amps and minimum circuit ampacities shall be included for single power connection.
 - 5. Conspicuously mark on each submittal the exact model, fittings, accessories, and devices to be supplied. When a schedule is shown on the drawings or in the specifications, provide a copy of that schedule with the shop drawing indicating the equipment capacities and characteristics of the actual equipment being proposed.
 - 6. Tags for equipment submitted shall match the tags indicated on the design drawings or specifications. Where equipment is noted on the drawings and not scheduled, refer to plan note and sheet number on the submittal.
- D. Project Record Documents:
 - 1. During the progress of the work of this section, this Contractor shall maintain an accurate record of all changes made in the installation of the system(s). Upon completion of the work, accurately transfer all record information and provide the owner with digital copies of the record documents.
- E. Operation and Maintenance Data:
 - 1. Include installation instructions, maintenance instructions, and spare parts lists.
 - 2. Keep in a safe place all keys, wrenches, and other specialty tools furnished with equipment. Present to owner at project close-out and receive a receipt showing they have received the same.
 - 3. Warranty Information
- F. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this section.

1.05 SUBSTITUTIONS

- A. The materials, products, and equipment described in these specifications or on the drawings establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Listing of these manufacturers shall in no way be construed as a device intended to limit the bidders to those specifically listed.
- B. Reference to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number, shall be interpreted as having established a standard of quality and shall not be construed as limiting competition. Articles, fixtures, etc. of equal quality by manufacturers listed in this specification for the applicable use, shall be acceptable, subject to performance, spatial, structural, and electrical constraints of the project design.
- C. No substitution will be considered unless written request for approval has been received by the engineer at least ten working days prior to the date for receipt of bids. Each such request shall include the name of the material or equipment for which it is to be substituted and complete description of the proposed substitute including shop drawings, performance and test data, and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment, or work that incorporation of the proposed substitute would require, shall be included. The burden of proof of the merit of the proposed substitute is on the proposer. The engineer's approval or disapproval of a proposed substitution shall be final.
- D. Approval of a proposed substitution prior to receipt of bids shall be set forth in an Addendum. Approvals made in any other manner shall not be considered binding.
- E. The Engineer reserves last opinion as to a product's equality or superiority to that specified.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.
- B. Comply with FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey requirements.
- C. Valves: Bear FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- E. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- F. Each major component of equipment shall have the manufacturer's name; address, model number and rating on a nameplate securely affixed.
- G. All equipment of one type (such as heads, pumps, valves, etc.) shall be the products of one manufacturer, unless otherwise specified.
- H. In the event of discrepancies between the drawings and specifications, the contractor shall advise the engineer before proceeding with the work in order that correct progress is ensued.
- I. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel." Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.

- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.08 OWNER TRAINING

- A. When training is required by any section of these specifications, all training sessions shall be recorded in a common digital format. Provide two copies recorded files at the end of construction. The contractor shall prepare a letter of receipt to be signed by the owner when the files are delivered.

1.09 CODES AND ORDINANCES

- A. All work shall be in accordance with applicable codes, rules, ordinances, and regulations of local, state, and federal governments and other authorities having jurisdiction.
- B. Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard, to any ordinances, laws, codes, rules, or regulations bearing on work, the contractor shall execute work in accordance with such without increased cost to the owner, but not until he has referred such variances to the engineer.
- C. The contractors shall secure and pay for the necessary permits and certificates of inspection for their trade. Keep record of all permits and inspections and submit two copies to the engineer with request for final inspection.

1.10 WARRANTY

- A. This contractor shall warrant that the complete systems installed under this contract shall be free of defects in workmanship and materials for a period of one (1) year from the date of substantial completion by the arch/owner.
- B. If defects occur during the one year guarantee period, this contractor shall repair or replace such defects at no expense to the owner and to the satisfaction of the owner and engineer.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Sprinkler-based System:
 - 1. Comply with NFPA 13.
 - 2. See Section 211300.
- B. Standpipe and Hose System:
 - 1. Comply with NFPA 14.
 - 2. See Section 211200.
- C. Combined Sprinkler, Standpipe, and Hose System:
 - 1. Comply with NFPA 13 and NFPA 14.
 - 2. See Sections 211300 and 211200.
- D. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- E. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.
- F. All work performed shall provide a neat and workmanlike appearance when completed, to the satisfaction of the engineer.
- G. Provide 3-1/2" concrete base for all floor mounted equipment unless shown or noted otherwise. Provide 6x6 welded wire fabric reinforcing minimum or as required by the structural engineer.

2.02 BURIED PIPING

- A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
 - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded, ASME B16.25, butt weld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
 - 3. Joints: Welded in accordance with AWS D1.1/D1.1M.
 - 4. Casing: Closed glass cell insulation.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.
 - 3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 40, black.
 - 1. Steel Fittings: ASME B16.5 steel flanges and fittings.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.
- B. CPVC Pipe: ASTM F442/F442M, SDR 13.5.
 - 1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
 - 2. Joints: Solvent welded, using ASTM F493 cement.
- C. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: AWWA C110/A21.10, standard thickness.
 - 2. Joints: AWWA C111/A21.11, SBR or vulcanized styrene-butadiene rubber gasket.

2.04 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc-coated or cast-iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- F. Clearances:
 1. Provide allowance for insulated piping.
 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.05 PIPE SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 1. Advance Products & Systems, Inc: www.apsonline.com/#sle.
 2. GPT, a company of Enpro Industries, Inc: www.gptindustries.com/#sle.
 3. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- B. Modular Mechanical Seals:
 1. Elastomer-based interlocking links to continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
 2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
 3. Size and select seal component materials in accordance with service requirements.
 4. Service Requirements:
 - a. Corrosion resistant.
 - b. Underground, buried, and wet conditions.
 5. Glass-reinforced plastic pressure end plates.
- C. Wall Sleeve: PVC material with waterstop collar, and nailer end caps.
- D. Sleeve-Forming Disk: Nonconductive plastic-based material, 3 inch thick.
- E. Pipeline-Casing Seals:
 1. End Seals: 1/8 inch, pull-on type, rubber or synthetic rubber based.

2.06 ESCUTCHEONS

- A. Manufacturers:
 1. Fire Protection Products, Inc: www.fppi.com/#sle.com/#sle.
 2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 3. Viking Group Inc: www.vikinggroupinc.com/#sle.
 4. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- B. Material:
 1. Chrome-plated.
 2. Metals and Finish: Comply with ASME A112.18.1.
- C. Construction:
 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.07 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 - 1. Manufacturers:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Ferguson Enterprises Inc: www.fnw.com/#sle.
 - c. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
 - 1. Manufacturers:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Ferguson Enterprises Inc: www.fnw.com/#sle.
 - c. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- C. Nonmetallic Piping Hangers:
 - 1. Manufacturers:
 - a. DecoShield Systems, Inc; Snap-2 Hangers: www.decoshield.com/#sle.
 - b. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
 - 1. Manufacturers:
- F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
 - 1. Manufacturers:
- G. Vertical Support: Steel riser clamp.
 - 1. Manufacturers:
 - a. Anvil International: www.anvilintl.com/#sle.
 - b. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 - 1. Manufacturers:
 - a. Anvil International: www.anvilintl.com/#sle.
 - b. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- I. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - 1. Manufacturers:
- J. Seismic Hangers and Couplings:
 - 1. Provide coupling with a factory set disengagement rating of 140 percent to 160 percent of the static weight.
 - 2. Provide resettable and reusable, break away couplings.
 - 3. Provide tether cables to avoid excessive seismic joint movement.
 - 4. Coupling to be manufactured from non-corrosive materials.
 - 5. Manufacturers:
 - a. The Metraflex Company; Seismic BreakAway Hanger: www.metrafire.com/#sle.

- b. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.

2.08 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID

- A. Manufacturers:
 1. The Metraflex Company; FireLoop: www.metrafire.com/#sle.
 2. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.
- B. Provide flexible loops with two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return with support bracket and air release or drain plug.
- C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- D. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
 1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
 2. Accommodate the Following:
 - a. Axial Deflection in Compression and Expansion: .
 - b. Lateral Movement: .
 - c. Angular Rotation: 15 degrees.
 - d. Force developed by 1.5 times specified maximum allowable operating pressure.
 3. End Connections: Same as specified for pipe jointing.
 4. Provide necessary accessories including, but not limited to, swivel joints.

2.09 MECHANICAL COUPLINGS

- A. Manufacturers:
 1. Anvil International: www.anvilintl.com/#sle.
 2. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
 3. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 4. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.
- B. Rigid Mechanical Couplings for Grooved Joints:
 1. Dimensions and Testing: Comply with AWWA C606.
 2. Minimum Working Pressure: 300 psig.
 3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
 4. Housing Coating: Factory applied orange enamel.
 5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
 6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

2.10 MECHANICAL PRESSED FITTINGS

- A. Manufacturers:
 1. Apollo Valves: www.apollovalves.com/#sle.
 2. Viega LLC; MegaPress: www.viega.us/#sle.
- B. Provide double-pressed type, utilizing EPDM, nontoxic, synthetic rubber sealing elements for use with Schedule 40 carbon steel piping.

2.11 RETROFIT-SPRINKLER PIPING COVER SYSTEM

- A. Manufacturers:
 1. DecoShield Systems, Inc: www.decoshield.com/#sle.
 2. Submit for pre-approval for manufacturer not listed but equivalent to those listed above.

B. General Requirements:

1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.

C. Materials:

1. Piping Cover System: Removal-resistant, modular, snap-fit cover units, clips, and anchors for use with CPVC, steel, and copper piping systems.
2. Cover Units: L-shaped and U-shaped cross-section units of flame retardant resin material, paintable finish.
3. Unit Length: 7.5 feet.
4. Provide sidewall sprinkler head housing in compliance with NFPA 13.
5. Provide coupling fittings for joining units end to end and prefabricated inside and outside corner fittings and end caps as required.
6. Provide mounting clips to secure covers to wall-ceiling per manufacturer requirements.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
- C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- D. Install piping to conserve building space, to not interfere with use of space and other work.
- E. Any item connecting to building structure shall be done in a manner accepted by the structural engineer.
- F. When bar joists are used for steel construction, items shall be supported from angle iron spanning the top chord of the joists.
- G. Locations of equipment, piping, and other work are indicated diagrammatically on the drawings. Each contractor shall coordinate exact locations subject to structural conditions, work of other contractors, access requirements, and the approval of the architect and engineer.
- H. Group piping whenever practical at common elevations.
- I. Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification.
- J. Contractor shall perform initial start-up of systems. Owner's operating personnel shall be present during this operation.
- K. It is the contractor's responsibility to provide materials and trim which properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.
- L. This contractor shall provide all miscellaneous steel, etc., for the proper installation of the systems specified and/or indicated on the plans.

- M. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- N. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- O. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- P. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- Q. Structural Considerations:
 - 1. Do not penetrate building structural members unless indicated.
 - 2. Locate flexible expansion loops at or near the building seismic joint.
- R. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
 - 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 - 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 - 3. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
 - 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- S. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a watertight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- T. Escutcheons:
 - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- U. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. Periodically during construction and prior to Owner acceptance of the building, Contractor shall remove from the premises and dispose of all packing material and debris.

END OF SECTION 210500

SECTION 210523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 210553 - Identification for Fire Suppression Piping and Equipment.

1.02 REFERENCE STANDARDS

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies 2022.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Comply with NFPA 13 and NFPA 13R for valves.
- B. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.

2.02 BRONZE BUTTERFLY VALVES WITH INDICATORS

- A. Minimum Pressure Rating: 175 psig.
- B. Body Material: Bronze.
- C. Seat: EPDM.
- D. Stem: Bronze or stainless steel.
- E. Disc: Bronze with EPDM coating.
- F. Actuator: Worm gear or traveling nut.
- G. Supervisory Switch: Internal or external.

2.03 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Minimum Pressure Rating: 175 psig.
- B. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
- C. Seat: EPDM.
- D. Stem: Stainless steel.
- E. Disc: Ductile iron, nickel plated.
- F. Actuator: Worm gear or traveling nut.
- G. Supervisory Switch: Internal or external.
- H. Body Design: Grooved-end connections.

2.04 CHECK VALVES

- A. Minimum Pressure Rating: 175 psig.
- B. Type: Center guided check valve.
- C. Body Material: Cast iron, ductile iron.
- D. Center guided check with elastomeric seal.
- E. Hinge Spring: Stainless steel.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- F. End Connections: Flanged, grooved, or threaded.

2.05 IRON OS&Y GATE VALVES

- A. Maximum Working Pressure: 175 psi.
- B. Body and Bonnet Material: Cast or ductile iron.
- C. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
- D. Stem: Brass, bronze, or stainless steel.
- E. Packing: Non-asbestos PTFE.
- F. Supervisory Switch: External.

2.06 TRIM AND DRAIN VALVES

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with specific valve installation requirements and application in the following Sections:
- B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
- C. Valves in horizontal piping installed with stem at or above the pipe center.
- D. Position valves to allow full stem movement.
- E. Install valve tags. Comply with Section 210553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 210523

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

SECTION 210553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Automatic Controls: Tags.
- B. Control Panels: Nameplates.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

END OF SECTION 210553

**SECTION 210719
FIRE SUPPRESSION PIPING INSULATION**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Armacell LLC: www.armacell.us/#sle.
 - 2. K-Flex USA LLC: www.kflexusa.com/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M, Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION 210719

**SECTION 211300
FIRE-SUPPRESSION SPRINKLER SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. Dry-pipe sprinkler system.
- C. Deluge sprinkler system.
- D. Preaction sprinkler system.
- E. System design, installation, and certification.
- F. Fire department connections.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 078700 - Smoke Containment Barriers: Smoke and fire curtains to be released by activation of sprinkler system.
- C. Section 149100 - Facility Chutes: Sprinkler heads inside chutes.
- D. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.
- E. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- F. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
- G. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- H. Section 211200 - Fire-Suppression Standpipes.
- I. Section 213000 - Fire Pumps.
- J. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- K. Section 284600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide current edition.
- B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.
- C. ICC-ES AC106 - Acceptance Criteria for Pre drilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- F. ITS (DIR) - Directory of Listed Products Current Edition.
- G. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies 2022.
- I. NFPA 1963 - Standard for Fire Hose Connections 2019.
- J. UL (DIR) - Online Certifications Directory Current Edition.

- K. UL 405 - Standard for Safety Fire Department Connection Devices Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. The piping indicated on the plans are schematic in nature and are provided mainly for coordination purposes. The actual design and final head placement shall be determined by the fire protection engineer designing the system.
- D. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Comply with FM (AG) requirements.
- C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- E. Equipment and Components: Provide products that bear FM (AG) label or marking.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
 - 1. Anvil International: www.anvilintl.com/#sle.
 - 2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
 - 3. Viking Corporation: www.vikinggroupinc.com/#sle.
 - 4. Central Sprinkler

2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Light hazard; comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Interface system with building control system.
- E. Provide fire department connections where indicated and required by local Authority Having Jurisdiction and NFPA.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.
- G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
 - 6. Other Types: As required.
 - 7. Manufacturers:
 - a. AFCON, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Powers Fasteners, Inc www.powers.com/#sle.

2.03 SPRINKLERS

- A. Semi-recessed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
 - 4. Manufacturers:
 - a. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
- B. Pendant type with guard.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Finish: Brass.
 - 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- C. Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
 - 1. Response Type: Quick.
 - 2. Coverage Type: Standard.
 - 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
 - 1. Response Type: Quick.

2. Coverage Type: Standard.
3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- E. Residential Sprinklers: Concealed upright type with matching push on escutcheon plate.
 1. Response Type: Quick.
 2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- F. Storage Sprinklers: Pendant type with guard.
 1. Response Type: Standard.
 2. Coverage Type: Standard.
 3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- G. Guards: Finish to match sprinkler finish.
- H. Spray Nozzles: Brass with solid cone discharge, 30 degrees of arc with blow-off dust cap.
- I. Flexible Drop System: Stainless steel, multiple use, open gate type.
 1. Application: Use to properly locate sprinkler heads.
 2. Include all supports and bracing.
 3. Provide braided type tube as required for the application.
 4. Manufacturers:
 - a. FlexHead Industries, a brand of Anvil International: www.anvilintl.com/#sle.
 - b. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.

2.04 PIPING SPECIALTIES

- A. All control valves in the sprinkler system shall be provided with supervisory switches. Switches will alarm when a valve is not in its normal operating position.
- B. Provide water flow alarm apparatus for the system. Alarm device shall be a listed alarm check valve with all necessary attachments required to give an alarm. Flow alarm devices shall be installed per NFPA requirements.
- C. Provide flow switches as required by NFPA.
- D. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
 1. Activate electric alarm.
 2. Test and drain valve.
 3. Replaceable internal components without removing valve from installed position.
 4. Manufacturers:
 - a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.
- E. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:
 1. Activate electric alarm.
 2. Test and drain valve.
 3. Externally resettable.
 4. Replaceable internal components without removing valve from installed position.
 5. Manufacturers:
 - a. Victaulic Company; Series 768 - NXT: www.victaulic.com/#sle.
- F. Flooding Deluge Valve: Gate type valve with rubber faced disc actuated manually with water motor alarm and electric alarm, with alarm testing trim.

- G. Preaction Valve:
 - 1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
 - 2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
 - 3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.
- H. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
- I. Test Connections:
 - 1. Inspector's Test Connection for Preaction Systems:
 - a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
 - b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
 - c. Supply discharge orifice with same size as corresponding sprinkler orifice.
 - d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.
 - 2. Backflow Preventer Test Connection:
 - a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
 - b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
 - c. Provide permanent sign reading "Test Valve" in accordance with Section 210553.
- J. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- K. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
- L. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- M. Fire Department Connections:
 - 1. Type: Free standing made of corrosion resistant metal complying with UL 405.
 - a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
 - b. Sleeve: Brass, 18 inches height.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Design and install a complete automatic sprinkler system for fire protection. All elements and components of the system shall be in compliance with NFPA Pamphlet 13 and 13R, "Standard for the Installation of Sprinkler Systems". Components shall be listed in current Underwriters Laboratories "Fire Protection Equipment List". Final acceptance shall be based on submission of test certificates, and completion of all regulatory body recommendations submitted following their final inspection.
- B. Design and install in accordance with referenced NFPA design and installation standard.
- C. Size sprinkler piping by hydraulic calculations in accordance with NFPA Standard 13, Chapter 7. Hydraulic calculations shall include inside and outside hose requirements. Hose requirements shall be inserted at the locations in the system per NFPA. Pipe sizing shall provide an

allowance of 10 psig in excess of base requirements. Head locations shall conform to the spacing shown on the Mechanical Drawings, Architectural Drawings, the Architectural Details, and elsewhere as required to provide a fully sprinklered building.

- D. The systems shall be designed by a licensed Fire Protection Engineer and installed by a licensed Sprinkler Contractor in full accordance with NFPA and all codes and standards. Shop drawings, layout and design shall be approved by the Local Authority Having Jurisdiction and the Engineer prior to installation
- E. Install equipment in accordance with manufacturer's instructions.
- F. Install buried shut-off valves in valve box. Provide post indicator.
- G. Provide approved double check valve assembly at sprinkler system water source connection.
- H. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- I. Locate outside alarm gong on building wall as indicated.
- J. Place pipe runs to minimize obstruction to other work.
- K. Place piping in concealed spaces above finished ceilings.
- L. Sprinkler heads in areas with sheet rock ceilings shall be fully recessed head type.
- M. Sprinkler heads in lay-in ceilings shall be located in the center of ceiling tiles with a tolerance of +/- 2 inches.
- N. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- O. Install air compressor on vibration isolators. Refer to Section 210548.
- P. Flush entire piping system of foreign matter.
- Q. Install guards on sprinklers where indicated.
- R. Hydrostatically test entire system.
- S. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 211300

**SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
- B. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- C. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
 - 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

- A. Pipe Sleeve Material:
 - 1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
 - 2. Masonry Structures: Sheet metal or fiber.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- E. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

City of Lee's Summit

Fire Station

Lee's Summit, Missouri

3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 220517

**SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Angle valves.
- B. Ball valves.
- C. Butterfly valves.
- D. Check valves.

1.02 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- D. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).
- E. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- F. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- G. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- H. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- I. NSF 61 - Drinking Water System Components - Health Effects 2021.
- J. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.03 SUBMITTALS

- A. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.04 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball, butterfly, gate or plug.
 - 2. Dead-End: Single-flange butterfly (lug) type.
 - 3. Throttling: Provide globe, angle, ball, or butterfly.
- B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- C. Low Pressure, Compressed Air Valves 150 psig or Less:
 - 1. 2 NPS and Smaller:

- a. Bronze: Provide with solder-joint ends.
 - b. Ball: One piece, full port, brass with brass trim.
- D. Domestic, Hot and Cold Water Valves:
 - 1. 2 NPS and Smaller:
 - a. Bronze and Brass: Provide with solder-joint ends.
 - b. Bronze Angle: Class 125, bronze disc.
 - c. Ball: One piece, full port, brass with brass trim.
 - d. Bronze Swing Check: Class 125, bronze disc.
 - 2. 2-1/2 NPS and Larger:
 - a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded ends.
 - b. Iron Ball: Class 150.
 - c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
 - d. Iron Swing Check: Class 125, metal seats.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
- D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
 - 1. Gate Valves: Rising stem.
 - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Solder Joint Connections: ASME B16.18.
- F. General ASME Compliance:
- G. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

2.03 BRONZE, ANGLE VALVES

- A. Class 125: CWP Rating: 200 psig.
 - 1. Comply with MSS SP-80, Type 1.
 - 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 - 3. Stem: Bronze.

2.04 BRASS, BALL VALVES

- A. One-Piece, Reduced-Port with Brass Trim:
 - 1. Comply with MSS SP-110.
 - 2. Body: Forged brass.
 - 3. Stem: Brass.
 - 4. Ball: Chrome-plated brass.
- B. Two Piece, Full Port with Press Connection:

2.05 BRONZE, BALL VALVES

- A. General:

City of Lee's Summit

Fire Station

Lee's Summit, Missouri

1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. One Piece, Reduced Port with Bronze Trim:
1. Comply with MSS SP-110.
 2. Body: Bronze.
 3. Seats: PTFE.

2.06 IRON, BALL VALVES

- A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72.
 2. Body: ASTM A536 Grade 65-45-12, ductile iron.
 3. Seats: PTFE.

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

2.08 BRONZE, SWING CHECK VALVES

- A. General:
1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.

2.09 IRON, HORIZONTAL SWING CHECK VALVES

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION 220523

SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 055000 - Metal Fabrications.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2018).
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- I. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
- L. MFMA-4 - Metal Framing Standards Publication 2004.
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- N. UL (DIR) - Online Certifications Directory Current Edition.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.05 QUALITY ASSURANCE

- A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Materials for Metal Fabricated Supports: Comply with Section 055000.
 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.02 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

- A. Strut Channels:
 1. Manufacturers:
 - a. ABB Installation Products: electrification.us.abb.com/#sle.
 - b. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
 2. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
 3. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
 1. Threaded zinc-plated steel unless otherwise indicated.
- C. Channel Nuts:
 1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.03 BEAM CLAMPS

- A. Manufacturers:
 - 1. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
 - 2. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.04 PIPE HANGERS

- A. Clevis Hangers, Adjustable:
 - 1. Manufacturers:
 - a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
 - b. nVent Caddy, a brand of nVent: www.erico.com/#sle.
 - 2. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
 - 3. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.05 PIPE CLAMPS

- A. Riser Clamps:
 - 1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
 - 2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 - 3. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

2.06 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Pipe Supports:
 - 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
 - 2. Liquid Temperatures Up to 122 degrees F:
 - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
 - b. Support From Below: MSS SP-58 types 35 through 38.
- C. Pipe Supports, Thermal Insulated:
 - 1. General Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Provide pipe supports for 1/2 to 30 inch iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
 - 2. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
- c. Minimum Thickness: 60 mil, 0.06 inch.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners according to manufacturer's recommended torque settings.
- I. Remove temporary supports.

END OF SECTION 220529

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tags.
- B. Stencils.
- C. Pipe markers.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Tags:
 - 1. Piping: 3/4 inch diameter and smaller.
 - 2. Manual operated and automated control valves.
 - 3. Instrumentation, relays, gauges, and other related control equipment products.
- B. Stencil:
- C. Pipe Markers: 3/4 inch diameter and higher.

2.02 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
 - 2. Brady Corporation: www.bradycorp.com/#sle.
 - 3. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 - 5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 - 6. Seton Identification Products: www.seton.com/#sle.

2.03 STENCILS

- A. Manufacturers:
- B. Pipe: Stencil size required per external insulated or uninsulated pipe diameter.
 - 1. 3/4 to 1-1/4 inch Range: 1/2 inch text over 8 inch long background.
 - 2. 1-1/2 to 2 inch Range: 3/4 inch text over 8 inch long background.
- C. Fluid Service Identification Scheme, ASME A13.1:
 - 1. Water; Potable, Cooling, Boiler Feed and Other: White text on green background.

2.04 PIPE MARKERS

- A. Manufacturers:

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Install tags in clear view and align with axis of piping
- C. Apply stencil painted identification in compliance with Section 099123 requirements. Identify unit with assigned id-number and area being served using pipe marking rules.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

END OF SECTION 220553

**SECTION 220719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.02 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 2019.
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022.
- D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

City of Lee's Summit

Fire Station

Lee's Summit, Missouri

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
 2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
 3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETING AND ACCESSORIES

- A. PVC Plastic Jacket:
 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids above ambient temperature:
 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

END OF SECTION 220719

**SECTION 221005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, buried within 5 feet of building.
- D. Domestic water piping, above grade.
- E. Storm drainage piping, buried within 5 feet of building.
- F. Storm drainage piping, above grade.
- G. Natural gas piping, buried within 5 feet of building.
- H. Natural gas piping, above grade.
- I. Pipe flanges, unions, and couplings.
- J. Pipe hangers and supports.
- K. Ball valves.
- L. Balancing valves.
- M. Pressure reducing valves.
- N. Strainers.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels.
- B. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.
- C. Section 220553 - Identification for Plumbing Piping and Equipment.
- D. Section 312316 - Excavation.
- E. Section 312323 - Fill.
- F. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

- A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- E. ASME B31.1 - Power Piping 2020.
- F. ASME B31.9 - Building Services Piping 2020.
- G. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

- J. ASTM B32 - Standard Specification for Solder Metal 2020.
- K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- P. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.
- Q. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings 2020.
- R. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- S. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- T. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
- U. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- V. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- W. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.
- X. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- Y. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.
- Z. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- AA. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- BB. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- CC. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- DD. NSF 61 - Drinking Water System Components - Health Effects 2021.
- EE. NSF 372 - Drinking Water System Components - Lead Content 2022.
- FF. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Pipe: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
 - 3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Viega LLC: www.viega.us/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.08 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Polyethylene: Plexco PE2406, SDR11, polyethylene with #12 copper tracer wire and anodeless risers where rising above grade.

2.09 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 2. Joints: Threaded or welded to ASME B31.1.
 3. Fittings: Viega Megapress fittings
- B. Flexible Gas Piping:
1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
 2. Comply with ASTM E84.
 3. Fittings: Provided by piping system manufacturer.

2.10 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Sizes Over 1 inch:
- C. No-Hub Couplings:
1. Testing: In accordance with ASTM C1277 and CISPI 310.
 2. Gasket Material: Neoprene complying with ASTM C564.
 3. Band Material: Stainless steel.
 4. Eyelet Material: Stainless steel.

2.11 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
 4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
 5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
 4. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
 5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 6. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
 2. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
 3. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.

2.12 BALL VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Grinnell Products: www.grinnell.com/#sle.
 - 3. Nibco, Inc: www.nibco.com/#sle.
 - 4. Viega LLC: www.viega.us/#sle.
- B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.13 BALANCING VALVES

- A. Manufacturers:
 - 1. Anvil International: www.anvilintl.com/#sle.
 - 2. Griswold Controls: www.griswoldcontrols.com/#sle.
 - 3. Taco, Inc: www.taco-hvac.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Construction: Class 125, brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- C. Calibration: Control flow within five percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.14 PRESSURE REDUCING VALVES

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com/#sle.
 - 2. Apollo Valves: www.apollovalves.com/#sle.
 - 3. Watts Regulator Company: www.wattsregulator.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. 2 inch and Smaller:
 - 1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
 - 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, pressure gauges, and isolation valves.
- C. 2 inch and Larger:
 - 1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
 - 2. Pressure Reducing Pilot-Operator:
 - a. Operating Range: 5 to 50 psi.
 - b. Connected into brass or bronze pilot piping and fittings.
 - c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.15 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 2. Jomar Valves, a division of Jomar Group: www.jomarvalve.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.

- B. Size 1/2 inch to 3 inch:
 - 1. Class 150, threaded forged bronze Y-pattern body, stainless steel perforated mesh screen with cap, and rated for 150 psi, 250 deg F WOG service.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 220516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 083100.
- I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; see Section [].
- J. Excavate in accordance with Section 312316.
- K. Backfill in accordance with Section 312323.
- L. Install valves with stems upright or horizontal, not inverted. See Section 220523.
- M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- N. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- O. Sleeve pipes passing through partitions, walls, and floors.
- P. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- Q. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.02 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 330110.58.
- B. Prior to starting work, verify system is complete, flushed, and clean.
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

3.03 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

3.04 SCHEDULES

- A. Pipe Hanger Spacing:
 1. Metal Piping:
 - a. Pipe Size: 1/2 inch to 1-1/4 inch:
 - 1) Maximum Hanger Spacing: 6.5 ft.
 - 2) Hanger Rod Diameter: 3/8 inches.
 - b. Pipe Size: 1-1/2 inch to 2 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.
 - c. Pipe Size: 2-1/2 inch to 3 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 1/2 inch.
 - d. Pipe Size: 4 inch to 6 inch:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 5/8 inch.
 2. Plastic Piping:
 - a. All Sizes:
 - 1) Maximum Hanger Spacing: 6 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 221005

**SECTION 221006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Washing machine boxes and valves.
- F. Refrigerator valve and recessed box.
- G. Backflow preventers.
- H. Double check valve assemblies.
- I. Water hammer arrestors.
- J. Sanitary waste interceptors.
- K. Mixing valves.
- L. Relief valves.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2003 (Reaffirmed 2012).
- B. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent 2021.
- C. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.
- D. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies 2021.
- E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- F. DIN 19580 - Drainage Channels for Vehicular and Pedestrian Areas - Durability, Mass Per Unit Area and Evaluation of Conformity 2010.
- G. NSF 61 - Drinking Water System Components - Health Effects 2021.
- H. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - 2. Josam Company: www.josam.com/#sle.
 - 3. Zurn Industries, LLC: www.zurn.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Roof Drains:
 - 1. Assembly: ASME A112.6.4.
 - 2. Body: Lacquered cast iron with sump.
 - 3. Strainer: Removable polyethylene dome with vandal proof screws.
 - 4. Accessories: Coordinate with roofing type:
 - 5. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - b. MIFAB, Inc: www.mifab.com/#sle.
 - c. Zurn Industries, LLC; Z100: www.zurn.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- C. Floor Drains:
 - 1. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - b. MIFAB, Inc: www.mifab.com/#sle.
 - c. Zurn Industries, LLC: www.zurn.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- D. Prefabricated Trench Drain: Trench drain system assembled from factory fabricated, polymer concrete castings in standard lengths and variable depths, with integral joint flanges and integral grating support rails; includes joint gaskets and grating.
 - 1. Basis of Design is as scheduled on the drawings.
 - 2. ABT Polydrain
 - 3. Zurn
 - 4. JR Smith
 - 5. Mifab
 - 6. Load Class: DIN 19580, Class C.
 - 7. Trench Width: 8 inches.
 - 8. Trench Section Length: As Scheduled
 - 9. Grating Support Rail: As scheduled.

2.03 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - 2. Josam Company: www.josam.com/#sle.
 - 3. MIFAB, Inc; C1100-R: www.mifab.com/#sle.
 - 4. Zurn Industries, LLC: www.zurn.com/#sle.
- B. Cleanouts at Exterior Surfaced Areas (CO-1):
 - 1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
- D. Cleanouts at Interior Finished Floor Areas (CO-3):
 - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed

cover to accept floor finish in finished floor areas.

- E. Cleanouts at Interior Finished Wall Areas (CO-4):
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

- A. Manufacturers:
 - 1. As scheduled.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.05 HYDRANTS

- A. Wall Hydrants:
 - 1. ASSE 1019; freeze resistant, self-draining type with chrome-plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

2.06 WASHING MACHINE BOXES AND VALVES

- A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.07 REFRIGERATOR VALVE AND RECESSED BOX

- A. Box Manufacturers:
 - 1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.08 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. MIFAB, Inc; FRP: www.mifab.com/#sle.
 - 3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Reduced Pressure Backflow Preventer Assembly:
 - 1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
 - 2. Size: [] inch assembly with threaded gate valves.
- C. Reduced Pressure Backflow Preventer Assembly:
 - 1. ASSE 1013 and NSF 61 compliant reinforced-nylon body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, integral male test fittings, and non-threaded vent outlet.
 - 2. Size: 3/4 to 2 inch assembly with threaded gate valves.
 - 3. Accessories: Provide air gap fitting, lead-free Y-strainer, and test cocks.

2.09 DOUBLE CHECK-VALVE ASSEMBLIES

- A. Manufacturers:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Apollo Valves: www.apollovalves.com/#sle.
 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 3. Zurn Industries, LLC; [____]: www.zurn.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Double Check Valve Assembly:
1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
 2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.
- C. Double Check Valve Assembly:
1. ASSE 1015 and NSF 61 compliant cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
 2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.
 3. Accessories: Provide lead-free Y-strainer and pit-mounted protective enclosure.

2.10 WATER HAMMER ARRESTORS

- A. Water Hammer Arrestors:

2.11 SANITARY WASTE INTERCEPTORS

- A. Manufacturers:
1. Striem.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Oil Interceptors:
1. Construction:
 - a. Material: Polyethylene.
 - b. Rough-in: As detailed on drawing..
 - c. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port.

2.12 MIXING VALVES

2.13 RELIEF VALVES

- A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION 221006

**SECTION 221500
GENERAL-SERVICE COMPRESSED-AIR SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rotary-screw air compressors.
- B. Reciprocating air compressors.
- C. Air dryers.
- D. Air receivers.
- E. Pipe and fittings.
- F. Unions and couplings.
- G. Air outlets.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 220513 - Common Motor Requirements for Plumbing Equipment.
- C. Section 220523 - General-Duty Valves for Plumbing Piping.
- D. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- D. ASME B31.1 - Power Piping 2020.
- E. ASTM B32 - Standard Specification for Solder Metal 2020.
- F. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 RECIPROCATING AIR COMPRESSORS

- A. Manufacturers:
 - 1. Ingersoll Rand, Inc: www.ingersollrandproducts.com/#sle.

2. Quincy Compressor, LLC: quincycompressor.com/#sle.
 3. Sullair, LLC: www.sullair.com/#sle.
 4. Atlas Copco.
- B. Type: Duplex air compressor system with fixed belt-driven mechanism.
- C. Capacity: 17.2 CFM of free air at 90 psi and 900 ft of altitude. Max pressure of 175 psi
- D. Electrically-driven, air-cooled compressor unit; factory-assembled on surface-mount tank with heat exchanger(s), air intake filter(s), gage(s), sight glasse(s), vibration isolators, thermostats, safeties, differential pressure oil pump, thermal overload protections, oil separator, moisture separator with drain trap, oil charging valve, and compressor bearings with ABMA STD 9, L10 life expectancy at 100,000 hours.
- E. Enclosure: Sound masking enclosure capable of reducing equipment generated noise down to 50 percent of generated loudness.
- F. Controls:
1. Indicators:
 - a. Air temperature.
 - b. Oil temperature.
 - c. Hour meter.
 - d. Air discharge pressure.
 - e. Sump pressure.
 - f. Air intake filter loading.
 - g. Anti-recycle timer.
 - h. Phase loss/reversal monitor.
 2. Pushbutton or Handswitch: Start/stop and load/unload functions.
- G. Electrical:
1. 5 hp at 200-VAC, 50 to 60 hz, TEFC motor, vfd controlled.
 2. Factory mount disconnect switch with terminal box with each circuit identified and spare spare to accommodate field-installed components. Ground each component to base of assembly.
- H. Provide with rubber isolator pads.

2.02 AIR DRYERS

- A. Type: Self-contained mechanical refrigeration type complete with heat exchanger, refrigeration compressor, automatic controls, moisture removal trap, internal wiring and piping, and full refrigerant charge.
- B. Air Connections: Inlet and outlet connections at same level, factory insulated.
- C. Accessories: Air inlet temperature gauge, air inlet pressure gauge, on/off switch, high temperature light, power on light, refrigerant gauge, air outlet temperature gauge, air outlet pressure gauge.

2.03 AIR RECEIVERS

- A. Receiver: Vertical, built to ASME regulations for working pressure of up to 150 psi. Flange or screw inlet and outlet connections.
- B. Tank Size:
1. Capacity: 80 gal.

2.04 PIPE AND FITTINGS

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn.

City of Lee's Summit

Fire Station

Lee's Summit, Missouri

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade Sn95.

2.05 UNIONS AND COUPLINGS

A. Unions:

1. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.

2.06 AIR OUTLETS

A. Quick Connector: 3/8 inch brass, snap-on connector with self closing valve, Style A.

2.07 HOSE REELS

A. Manufacturer: Coxreels, or similar

1. 50ft., 3/8" hose with standard air fitting on end.

B. Construction: Steel construction with powdercoat finish.

C. Hose: PVC with hose stop.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install compressor unit on concrete housekeeping pad. See Section 033000.

C. Install compressor unit on vibration isolators. Level and bolt in place. See Section 220548.

D. Place shut off valve on water inlet to aftercooler. Pipe drain to floor drain. See Section 220523.

E. Install valved bypass around air dryer. Factory insulate inlet and outlet connections. See Section 220523.

F. Install valved drip connections at low points of piping system. See Section 220523.

3.02 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.

C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.

D. Cap and seal ends of piping when not connected to mechanical equipment.

END OF SECTION 221500

**SECTION 223000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial gas-fired water heaters.
- B. Water heaters.
- C. Domestic hot water storage tanks.
- D. In-line circulator pumps.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Commercial Gas-Fired Water Heaters:
 - 1. Manufacturers:
 - a. As scheduled.
 - 2. Type: Automatic, natural gas-fired, vertical storage.
 - 3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
 - 4. Performance:
 - 5. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
 - 6. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - 7. Applications:

2.02 DOMESTIC HOT WATER STORAGE TANKS

- A. Tank: Welded steel, ASME labeled for working pressure of 125 psig, steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole.
- B. Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; flanged collar for heat exchanger; manway fitting.

2.03 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 - 1. As scheduled.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Domestic Water Storage Tanks:
 - 1. Provide steel pipe support, independent of building structural framing members.
 - 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.
- D. Pumps:
 - 1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 223000

**SECTION 224000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush valve water closets.
- B. Tank type water closets.
- C. Dual flush water closets.
- D. Lavatories.
- E. Sinks.
- F. Under-lavatory pipe supply covers.
- G. Showers.
- H. Electric water coolers.
- I. Mop sinks.
- J. Service sinks.

1.02 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 221006 - Plumbing Piping Specialties.
- C. Section 223000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration 2008 (Reaffirmed 2013).
- C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- D. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2022).
- F. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
- G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2022.
- H. ASME A112.19.14 - Six-Liter Water Closets Equipped with a Dual Flushing Device 2013 (Reaffirmed 2018).
- I. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2020.
- J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2021.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- L. NSF 61 - Drinking Water System Components - Health Effects 2021.
- M. NSF 372 - Drinking Water System Components - Lead Content 2022.
- N. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

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

- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

- A. Water Closets:
 - 1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
 - 2. Flush Valve: Exposed (top spud).
 - 3. Flush Operation: Sensor operated.
 - 4. Handle Height: 44 inches or less.
 - 5. Manufacturers:
 - a. American Standard, Inc; Baby Devoro, 2-Piece Gravity: www.americanstandard-us.com/#sle.
 - b. Kohler Company: www.kohler.com/#sle.
 - c. Zurn Industries, LLC: www.zurn.com/#sle.
 - d. Toto
- B. Flush Valves:
 - 1. Manufacturers:
 - a. Sloan Valve Company: www.sloanvalve.com/#sle.
 - b. Zurn Industries, LLC; ZEMS Series: www.zurn.com/#sle.
 - c. Toto.
 - 2. Manual Operated:
 - a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
 - b. Supplied Volume Capacity: 1.5 gal per flush.
 - 3. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.
- C. Toilet Seats:
 - 1. Manufacturers:
 - a. Bemis Manufacturing Company: www.bemismfg.com/#sle.
 - b. Church Seat Company: www.churchseats.com/#sle.
 - c. Toto.
 - 2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

2.04 TANK TYPE WATER CLOSETS

- A. Manufacturers:
 - 1. American Standard, Inc; Baby Devoro, Flo-Wise, 2-Piece Gravity: www.americanstandard-us.com/#sle.
 - 2. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
 - 3. Kohler Company: www.kohler.com/#sle.

4. Toto.

B. Seat Manufacturers:

1. Bemis Manufacturing Company: www.bemismfg.com/#sle.
2. Church Seat Company: www.churchseats.com/#sle.
3. Toto.

2.05 DUAL FLUSH WATER CLOSETS

- A. ASME A112.19.14; high efficiency and low consumption, vitreous china, dual flush, tank type.
1. Bowl: Elongated.
 2. Rough In: 12 inch.
 3. Seat: Manufacturer's standard or recommended elongated closed front seat with lid.
 4. Color: White.

2.06 LAVATORIES

- A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Kohler Company: www.kohler.com/#sle.
 3. Toto.
- B. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 2.2 gallons per minute, indexed handles.
- C. Thermostatic Mixing Valve:
1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.
- D. Accessories:
1. Chrome-plated 17 gauge, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
- E. Lavatory Carrier:
1. Manufacturers:
 - a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - b. Zurn Industries, LLC; Z1231: www.zurn.com/#sle.
 2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.07 SINKS

- A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 3. Kohler Company: www.kohler.com/#sle.
 4. Elkay.

2.08 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. Basis of Design: Plumberex Specialty Products, Inc; www.plumberex.com/#sle.
1. Fusion Molded Under-Lavatory Insulators (Non-Sewn): Plumberex Handy-Shield Maxx.
- B. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
 2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Comply with ASTM C1822 Type I for covers on accessible lavatory piping.

- b. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
- c. Comply with ICC A117.1.

2.09 SHOWERS

- A. Shower Valve:
 - 1. Comply with ASME A112.18.1.
- B. Wall Mounted Shower Valve:
 - 1. Comply with ASME A112.18.1.
- C. Shower Head:
 - 1. ASME A112.18.1; chrome-plated vandal-proof institutional head with integral wall bracket, built-in 2.5 gpm flow control.

2.10 ELECTRIC WATER COOLERS

- A. Manufacturers:
 - 1. Elkay Manufacturing Company: www.elkay.com/#sle.
 - 2. Haws Corporation: www.hawesco.com/#sle.
- B. Water Cooler: Electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
 - 1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
 - 2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.
- C. Bottle Filler: Materials to match fountain.

2.11 MOP SINKS

- A. Manufacturers:
 - 1. As scheduled.

2.12 SERVICE SINKS

2.13 EMERGENCY EYE WASH

- A. Emergency Wash: ANSI Z358.1; Deck mounted , self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.
- B. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install components level and plumb.

3.02 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.03 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

3.04 CLEANING

- A. Clean plumbing fixtures and equipment.

3.05 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 224000

**SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators 2021.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 degrees F environment.
 - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- C. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 APPLICATIONS

2.03 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Applications:
 - 1. Commercial:
 - a. Hydronic Pump:
 - 1) Operating Mode: Constant speed.
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the hydronic pump and/or specified sequence of operation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 230513

SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
- B. Clearances:
 - 1. Provide allowance for insulated piping.
 - 2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
 - 3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, partitions, and [_____]. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- E. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION 230517

**SECTION 230519
METERS AND GAUGES FOR HVAC PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).
- C. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance 2012, with Addendum (2018).
- D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

2.02 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - 2. Omega Engineering, Inc: www.omega.com/#sle.
 - 3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
- B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
- C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

2.04 TEST PLUGS

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install positive displacement meters with isolating valves on inlet and outlet to AWWA M6. Provide full line size valved bypass with globe valve for liquid service meters.
- C. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

END OF SECTION 230519

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ball valves.
- B. Check valves.

1.02 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- C. ASME B31.9 - Building Services Piping 2020.
- D. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- E. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- F. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- G. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.
- H. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- B. Provide the following valves for the applications if not indicated on drawings:
 - 1. Isolation (Shutoff): Butterfly, Gate, Ball, and Plug.
- C. Required Valve End Connections for Non-Wafer Types:
 - 1. Copper Tube:
 - a. Size 2 inch and Smaller: Threaded ends, except solder-joint valve-ends.
 - b. Size 2-1/2 inch and Larger: Grooved ends.
- D. Heating Hot Water Valves:
 - 1. Size 2 inch and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Ball: Full port, one piece, brass trim.
 - c. Swing Check: Bronze disc, Class 125.
 - 2. Size 2-1/2 inch and Larger, Iron Valves:
 - a. 2-1/2 inch to 4 inch: Threaded ends.
 - b. Ball: 2-1/2 inch to 10 inch, Class 150.
 - c. Swing Check: Metal seats, Class 125.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 - 1. Hand Lever: Quarter-turn valves 6 inch and smaller.
- D. Valves in Insulated Piping: Provide 2 inch stem extensions and the following features:
 - 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Solder Joint Connections: ASME B16.18.
- F. General ASME Compliance:
 - 1. Building Services Piping Valves: ASME B31.9.

2.03 BRASS, BALL VALVES

- A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:
 - 1. Comply with MSS SP-110.
 - 2. CWP Rating: 200 psi.
 - 3. Body: Forged brass.
 - 4. Ends: Threaded.
 - 5. Seats: PTFE or TFE.
 - 6. Stem: Brass.
 - 7. Ball: Chrome-plated brass.

2.04 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. One Piece, Reduced Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. CWP Rating: 400 psi.
 - 3. Ends: Threaded.
 - 4. Seats: PTFE.

2.05 IRON, BALL VALVES

- A. Split Body, Full Port:
 - 1. Comply with MSS SP-72.
 - 2. CWP Rating: 200 psi.
 - 3. Body: ASTM A126, gray iron.
 - 4. Ends: Flanged.
 - 5. Seats: PTFE.
 - 6. Stem: Stainless steel.
 - 7. Ball: Stainless steel.

2.06 BRASS, INLINE CHECK VALVES

- A. Class 150: CWP Rating: 200 psi .

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Maximum Service Temperature: 250 degrees F.
- C. Body: Forged brass.
- D. Disc: Forged brass.
- E. Seal: PTFE, bubble tight.
- F. End-Connections: Press.

2.07 BRASS, HORIZONTAL SWING CHECK VALVES

- A. Threaded End-Connections:
 - 1. Class 125: CWP Rating: 200 psi.
 - 2. Body: Forged brass.
 - 3. Disc: Forged brass.
 - 4. Hinge-Pin, Screw, and Cap: Forged brass.
- B. Press End-Connections:
 - 1. Class 125: WOG Rating: 200 psi.
 - 2. Body: Forged brass.
 - 3. Disc: Forged brass.
 - 4. Hinge-Pin, Screw, and Cap: Forged brass.

2.08 BRONZE, SWING CHECK VALVES

- A. Class 125:
 - 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 - 2. Design: Y-pattern, horizontal or vertical flow.
 - 3. WSP Rating: 200 psi.
 - 4. Body: Bronze, ASTM B62.
 - 5. End Connections: Threaded or soldered.
 - 6. Disc: Bronze.

2.09 IRON, FLANGED END SWING CHECK VALVES

- A. Class 125:
 - 1. 150 psi with metal seats.
 - 2. 200 psi with metal seats and nonmetallic-to-metal seats.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION 230523

SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2018).
- H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- I. FM (AG) - FM Approval Guide current edition.
- J. MFMA-4 - Metal Framing Standards Publication 2004.
- K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- L. UL (DIR) - Online Certifications Directory Current Edition.

1.02 SUBMITTALS

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

1.03 QUALITY ASSURANCE

- A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Prefabricated Trapeze-Framed Metal Strut Systems:
 - 1. Strut Channel or Bracket Material:
 - 2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.
- C. Hanger Rods:
 - 1. Threaded zinc-plated steel unless otherwise indicated.
- D. Pipe Supports:
 - 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
 - 2. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
- E. Beam Clamps:
 - 1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
 - 2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
 - 3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
 - 4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
 - 5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
 - 6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
 - 7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
 - 8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- F. Riser Clamps:
 - 1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
 - 2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 - 3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 - 4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
 - 5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.
- G. Pipe Hangers:
 - 1. Split Ring Hangers:
 - a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
 - b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
 - c. Provide hanger rod and nuts of the same type and material for a given pipe run.
 - d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- H. Anchors and Fasteners:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- G. Secure fasteners according to manufacturer's recommended torque settings.
- H. Remove temporary supports.

END OF SECTION 230529

**SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Vibration-isolated equipment support bases.
- C. Vibration isolators.

1.02 REFERENCE STANDARDS

- A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 SUBMITTALS

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
- D. Piping Isolation:
 - 1. Provide vibration isolators for piping supports:

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

2.03 VIBRATION ISOLATORS

- A. General Requirements:
 - 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
- B. Vibration Isolators for Nonseismic Applications:
 - 1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.

- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 4. Adjust isolators to be free of isolation short circuits during normal operation.
 - 5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 230548

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.

1.02 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Tags.
- B. Pumps: Nameplates.
- C. Small-sized Equipment: Tags.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc: www.pipemarker.com/#sle.
 - 2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 - 3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

END OF SECTION 230553

SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic systems.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Method of checking building static and exhaust fan and/or relief damper capacity.
 - f. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 5. Units of Measure: Report data in I-P (inch-pound) units only.
- E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- E. Pre-Qualified TAB Agencies:
 - 1. Pro Balance - Blue Springs, MO
 - 2. Enviromental System Testing, Inc. - Kansas City, KS
 - 3. Doyle Field Services - Kansas City, MO

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

3.03 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.04 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- I. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.06 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- C. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

END OF SECTION 230593

**SECTION 230713
DUCT INSULATION**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- C. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Duct insulation shall be as scheduled on the drawings.
- B. Manufacturer:
 - 1. CertainTeed Corporation; SoftTouch, type 150: www.certainteed.com/#sle.
 - 2. Johns Manville: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- C. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.

2.03 DUCT LINER

- A. Manufacturers:
 - 1. CertainTeed Corporation; ToughGard R Duct Liner type 200: www.certainteed.com/#sle.
 - 2. Johns Manville: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- B. Note: Choose the liner type - Elastomeric Foam or Glass Fiber.
- C. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
 - 1. Apparent Thermal Conductivity: Maximum of 0.24 at 75 degrees F.
 - 2. Service Temperature: Up to 250 degrees F.

City of Lee's Summit

Fire Station

Lee's Summit, Missouri

3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
4. Minimum Noise Reduction Coefficients:
 - a. 1/2 inch Thickness: 0.45.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Refer to Duct Insulation schedule for locations of insulation.

END OF SECTION 230713

**SECTION 230716
HVAC EQUIPMENT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment insulation.

1.02 REFERENCE STANDARDS

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 - 1. Aeroflex USA, Inc; Aerocel AC Sheet and Roll: www.aeroflexusa.com/#sle.
 - 2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
 - 3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B.

END OF SECTION 230716

**SECTION 230719
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.02 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- F. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces 2008 (Reapproved 2019).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

- A. Pipe insulation shall be as scheduled on the drawings.
- B. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
 - 2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
 - 3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.04 ACCESSORIES

- A. General Requirements:
 1. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
 2. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
 3. Supply materials that are asbestos free.
- B. Corrosion Inhibitors:
 1. Corrosion Control Gel:
 - a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- C. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- D. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- E. Inserts and Shields:
- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.
- G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

END OF SECTION 230719

**SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. HVAC&R Sensors:
 - 1. Nitrogen dioxide sensors.
 - 2. Carbon monoxide sensors.
 - 3. Carbon dioxide sensors.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 HVAC&R SENSORS

- A. Nitrogen Dioxide Sensors, for Single-Gang Electrical Box Mounting:
 - 1. General:
 - a. Provide packaged CO, NOX detectors where indicated on the drawings.
- B. Carbon Monoxide Sensors, for Single-Gang Electrical Box Mounting:
 - 1. General:
 - a. Provide packaged CO, NOX detectors where indicated on the drawings.
- C. Carbon Dioxide Sensors, Wall:
 - 1. General: Provide CO2 sensors with integral transducers and linear output.
 - 2. Provide packaged CO, NOX detectors where indicated on the drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats; see Section 262726.
- C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION 230913

**SECTION 231123
FACILITY NATURAL-GAS PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

- A. Section 230516 - Expansion Fittings and Loops for HVAC Piping.

1.03 REFERENCE STANDARDS

- A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
- B. ANSI Z223.1 - National Fuel Gas Code 2021.
- C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- E. ASME B31.1 - Power Piping 2020.
- F. ASME B31.9 - Building Services Piping 2020.
- G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- J. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: ANSI Z223.1, welded.
 - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.02 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.
 - 3. Fittings: Viega Megapress fittings are acceptable in lieu of steel.
- B. Flexible Gas Piping:
 - 1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
 - 2. Comply with ASTM E84.
 - 3. Fittings: Provided by piping system manufacturer.

2.03 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
- B. Flanges for Pipe Size Over 1 Inch:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.04 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.

2.05 BALL VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
 - 3. Nibco, Inc: www.nibco.com/#sle.
 - 4. Viega LLC: www.viega.us/#sle.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 230516.

- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- G. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- H. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

3.02 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.03 SCHEDULES

- A. Pipe Hanger Spacing:
 - 1. Metal Piping:
 - a. Pipe Size: 1/2 inches to 1-1/4 inches:
 - 1) Maximum Hanger Spacing: 6.5 ft.
 - 2) Hanger Rod Diameter: 3/8 inches.
 - b. Pipe Size: 1-1/2 inches to 2 inches:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 3/8 inch.
 - c. Pipe Size: 2-1/2 inches to 3 inches:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 1/2 inch.
 - d. Pipe Size: 4 inches to 6 inches:
 - 1) Maximum Hanger Spacing: 10 ft.
 - 2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION 231123

**SECTION 232113
HYDRONIC PIPING**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.02 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- C. ASME B31.9 - Building Services Piping 2020.
- D. ASTM B32 - Standard Specification for Solder Metal 2020.
- E. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- F. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- G. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2022a, with Editorial Revision.
- H. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems 2022.
- I. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2019).
- J. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing 2021.
- K. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- L. AWWA C606 - Grooved and Shouldered Joints 2015.
- M. DIN 4726 - Warm Water Surface Heating Systems and Radiator Connecting Systems - Plastics Piping Systems and Multilayer Piping Systems 2017.
- N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 - 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
 - 3. Grooved mechanical joints may be used in accessible locations only.
 - a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
 - b. Use rigid joints unless otherwise indicated.
 - 4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or

threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.

2.02 HEATING WATER AND GLYCOL PIPING, BURIED

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.

1. Manufacturers:
 - a. Uponor, Inc: www.uponorpro.com/#sle.
2. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.000044 grains per cu ft/day at 104 degrees F in accordance with DIN 4726.
3. Joints: Mechanical compression fittings.
4. Joints: ASTM F1960, cold-expansion fittings.

2.03 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 - b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.
 - a. Manufacturers:
 - 1) Apollo Valves: www.apollovalves.com/#sle.
 - 2) Grinnell Products: www.grinnell.com/#sle.
 - 3) Viega LLC: www.viega.us/#sle.

2.04 RADIANT HEATING PIPING, BELOW GRADE

A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.

1. Manufacturers:
 - a. Uponor, Inc: www.uponorpro.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.05 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

- B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.07 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe of 2 Inches and Less:
- B. Flanges for Pipe 2 Inches and Greater:
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 - 1. Dimensions and Testing: In accordance with AWWA C606.
 - 2. Mechanical Couplings: Comply with ASTM F1476.
 - 3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 - 4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

2.08 BALL VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Victaulic Company: www.victaulic.com/#sle.
 - 3. Viega LLC: www.viega.us/#sle.
- B. Up To and Including 2 Inches:
 - 1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

2.09 SWING CHECK VALVES

- A. Manufacturers:
 - 1. Apollo Valves: www.apollovalves.com/#sle.
 - 2. Grinnell Products: www.grinnell.com/#sle.
 - 3. Victaulic Company: www.victaulic.com/#sle.
- B. Up To and Including 2 Inches:
 - 1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and to avoid interference with use of space.
- D. Group piping whenever practical at common elevations.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- E. Slope piping and arrange to drain at low points.
- F. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.

3.03 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 - 1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION 232113

**SECTION 232114
HYDRONIC SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Strainers.
- E. Balancing valves.
- F. Relief valves.
- G. Glycol system.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

PART 2 PRODUCTS

2.01 EXPANSION TANKS

- A. Manufacturers:
 - 1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
 - 2. Amtrol Inc: www.amtrol.com/#sle.
 - 3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 - 4. Taco, Inc: www.taco-hvac.com/#sle.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, adjustable flexible EPDM diaphragm or bladder seal factory precharged to 12 psi, and steel support stand.
- C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.02 AIR VENTS

- A. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- B. Maximum Fluid Pressure: 150 psi.
- C. Maximum Fluid Temperature: 250 degrees F.

2.03 AIR SEPARATORS

A. Coalescing Air/Dirt Separators:

1. Manufacturers:
 - a. American Wheatley, a company of Global Flow Products, LLC:
www.wheatleyhvac.com/#sle.
 - b. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - c. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 - d. Spirotherm, Inc: www.spirotherm.com/#sle.
2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1 for maximum fluid service subject to application requirements and manufacturer's standard maximum operating conditions.
3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to top of separator.
5. End Connections: Class 150 flanged for 2-1/2 inch and larger otherwise threaded.
6. Blowdown Connection: Threaded.
7. Size: Match system flow capacity.
8. Maximum Fluid Service Pressure: 150 psi.
9. Maximum Fluid Service Temperature: 250 degrees F.

2.04 STRAINERS

A. Size 2 inch and Under:

1. Provide threaded or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
 - a. Cast Iron or Brass:
 - 1)
 - 2) Liquids: Up to 400 psi at 150 degrees F.

2.05 BALANCING VALVES

A. Manufacturers:

1. American Wheatley, a company of Global Flow Products, LLC:
www.wheatleyhvac.com/#sle.
2. Armstrong International, Inc: www.armstronginternational.com/#sle.
3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
4. Nexus Valve, Inc: www.nexusvalve.com/#sle.
5. Taco, Inc: www.taco-hvac.com/#sle.

B. Size 2 inch and Smaller:

1. Provide ball style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and sweat connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon, EPDM, engineered resin, or [_____].

2.06 RELIEF VALVES

- ### **A.**
- Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.07 GLYCOL SYSTEM

- A. Pump System:
 - 1. Storage: 15 gal polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
 - 2. Pump:
 - a. Thermally protected 1/4 hp motor at 115 to 120 VAC, single phase rated for indoor service.
 - b. Maximum Service Operation: 100 psi at 85 degrees F.
 - 3. Mechanical Accessories: System isolation valves, strainer, and pressure gauges.
 - 4. Control Panel:
 - a. Fused single-point system connection rated at 115 to 120 VAC, single phase.
 - b. Interface: Hand switches with indicating lights for ON, FAULT, and LOW LEVEL.
 - c. Pressure Switch: Panel-mounted and prewired for 10 psi cut-in and 40 psi cut-out, adjustable.
 - d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
 - 5. Pressure Relief Valve: System-mounted brass valve tubed from pump discharge side into tank with adjustable setpoint between 20 psi and 150 psi.
- B. Glycol Solution:
 - 1. Water-based solution mix containing 40 percent propylene glycol by volume required for cooling or heating system operating temperature range.
 - 2. Cooling or heating System Operating Temperature Range: Between freezing and boiling points of 3 and 220 degrees F at 14.7 psia.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- D. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- E. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- F. Pipe relief valve outlet to nearest floor drain.
- G. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.

END OF SECTION 232114

**SECTION 232123
HYDRONIC PUMPS**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 230513 - Common Motor Requirements for HVAC Equipment.
- B. Section 230934 - Variable-Frequency Motor Controllers.
- C. Section 253500 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

1.02 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 778 - Standard for Motor-Operated Water Pumps Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 GENERAL

- A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Electrical Requirements:
 - 1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.
 - 2. Variable Frequency Drives (VFDs): Provide in accordance with Section 230934, except for integral-VFDs.
 - 3. Enclosures: Provide unspecified product(s) required to fit motor:

2.02 CIRCULATORS

- A. Horizontal shaft, single-stage pump with direct connected, resilient-mount, oil lubricated motor for discharge pressures of up to 125 psi.
- B. Casing: Cast iron, with flanged pump connections.
- C. Impeller: Non-ferrous keyed to shaft.
- D. Bearings: Oil-lubricated bronze sleeve.
- E. Shaft: Alloy steel with bronze sleeve, integral thrust collar.
- F. Drive: Flexible coupling.
- G. Electrical:
 - 1. Motor: 1,750 rpm unless indicated otherwise; see Section 230513.
 - 2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- H. Pumps shall be as scheduled

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
- C. Controls Human-Machine Interface (HMI): HVAC operator terminal; see Section 253500.

END OF SECTION 232123

**SECTION 232300
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Filter-driers.

1.02 REFERENCE STANDARDS

- A. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.
- E. ASME B31.9 - Building Services Piping 2020.
- F. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- H. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
- I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- J. ICC (IMC)-2018 - International Mechanical Code 2018.
- K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- L. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Filter-Driers:
 - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2.02 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.9 for installation of piping system.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME BPVC-IX.

2.03 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
3. Mechanical Press Sealed Fittings: Not Permitted
- B. Copper Tube to 7/8-inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
 1. Fittings: ASME B16.26 cast copper.
 2. Joints: Flared.
 3. Mechanical Press Sealed Fittings: Not Permitted
- C. Pipe Supports and Anchors:
 1. Provide hangers and supports that comply with MSS SP-58.
 - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 6. Vertical Support: Steel riser clamp.
 7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 9. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 REFRIGERANT

- A. Refrigerant: R-410a as defined in ASHRAE Std 34.

2.05 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.06 VALVES

2.07 STRAINERS

2.08 FILTER-DRIERS

- A. Performance:
 1. Flow Capacity.
 2. Pressure Drop:
 3. Design Working Pressure:
- B. Cores:
- C. Construction:
 1. Connections:

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

END OF SECTION 232300

**SECTION 233100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 233319 - Duct Silencers.
- B. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.02 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
- F. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for duct materials.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.
- B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.
- C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.
- D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
 - 1. Round: Plus or minus 2 in-wc of galvanized steel.
 - 2. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.
 - 3. Flexible Duct (Fabric and wire): Plus or minus 1/2 in-wc; see Section 233700.
- E. Duct Sealing and Leakage in accordance with Static Pressure Class:
 - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
 - a. Supply Air: 1/2 in-wc pressure class, galvanized steel.
 - b. Return and Relief Air: 1/2 in-wc pressure class, galvanized steel.
 - c. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
 - 2. Low Pressure Service: Up to 2 in-wc:
 - a. Seal: Class C, apply to seal off transverse joints.
 - b. Leakage:
 - 1) Rectangular: Class 24 or 24 cfm/100 sq ft.
 - 2) Round: Class 12 or 12 cfm/100 sq ft.

F. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 METAL DUCTS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

2.03 FLEXIBLE DUCTS

A. Flexible Air Ducts:

1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
2. Pressure Rating: From 10 in-wc positive to 1 in-wc negative.
3. Maximum Velocity: 4,000 fpm.
4. Temperature Range: Minus 20 to 210 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.
- D. Flexible Ducts: Connect to metal ducts with adhesive.
- E. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.
- F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION 233100

**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backdraft dampers - metal.
- B. Combination fire and smoke dampers.
- C. Duct access doors.
- D. Fire dampers.
- E. Flexible duct connectors.
- F. Volume control dampers.
- G. Miscellaneous products:
 - 1. Damper operators.
 - 2. Damper position switch.

1.02 RELATED REQUIREMENTS

- A. Section 233100 - HVAC Ducts and Casings.
- B. Section 253513 - Integrated Automation Actuators and Operators: Damper operators.
- C. Section 253516 - Integrated Automation Sensors and Transmitters: Damper position switch.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
- C. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS - METAL

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 - 2. Nailor Industries, Inc: www.nailor.com/#sle.
 - 3. Ruskin Company: www.ruskin.com/#sle.
 - 4. United Enertech: www.unitedenertech.com/#sle.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
 - 1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 - 2. Nailor Industries, Inc: www.nailor.com/#sle.
 - 3. Pottorff: www.pottorff.com/#sle.

4. Ruskin Company: www.ruskin.com/#sle.
 5. United Enertech: www.unitedenertech.com/#sle.
- B. Provide factory sleeve and collar for each damper.
- C. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- D. Operators: UL listed and labeled; spring-return, pneumatic-type suitable for operation on 0-20 psig instrument air. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.
- E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

2.03 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.04 FIRE DAMPERS

- A. Manufacturers:
1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 2. Nailor Industries, Inc: www.nailor.com/#sle.
 3. Pottorff: www.pottorff.com/#sle.
 4. Ruskin Company: www.ruskin.com/#sle.
 5. United Enertech: www.unitedenertech.com/#sle.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

2.05 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
 2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.06 SMOKE DAMPERS

2.07 VOLUME CONTROL DAMPERS

- A. Manufacturers:
1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 2. Nailor Industries, Inc: www.nailor.com/#sle.
 3. Ruskin Company: www.ruskin.com/#sle.
 4. United Enertech: www.unitedenertech.com/#sle.
- B. Single Blade Dampers:
- C. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.

2.08 MISCELLANEOUS PRODUCTS

- A. Damper Operators: Provide electric operators; see Section 253513.

- B. Damper position switch; see Section 253516.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

END OF SECTION 233300

**SECTION 233423
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.
- B. Cabinet exhaust fans.
- C. Inline centrifugal fans and blowers.

1.02 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 ROOF EXHAUSTERS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - 2. Twin City Fan & Blower: www.tcf.com/#sle.
 - 3. Loren Cook.
- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.
- E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- F. Roof Exhausters shall be as scheduled on the plans.

2.03 CEILING EXHAUST FANS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - 2. Loren Cook.
- B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.
- C. Grille: Aluminum with baked white enamel finish.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- E. Performance Ratings: As indicated on drawings.

2.04 INLINE CENTRIFUGAL FANS AND BLOWERS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - 2. Twin City Fan & Blower: www.tcf.com/#sle.
 - 3. Loren Cook.
- B. Centrifugal Fan Unit: V-belt or direct driven, with galvanized steel housing lined with acoustic insulation, resiliently-mounted motor, gravity backdraft damper in discharge.
- C. Forward Curved Blower:
 - 1. Adjustable belt or direct-driven, resiliently-mounted induction motor, heavy duty ball bearings, galvanized steel housing for indoor or outdoor service lined with acoustic insulation, and removable service panels.
 - 2. Accessories: Provide intake hood with bird screen.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm gets reached with sheaves set at mid-position; fan shaft with self-aligning prelubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

END OF SECTION 233423

**SECTION 233439
HIGH-VOLUME, LOW-SPEED PROPELLER FANS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High-volume, low-speed propeller fans.

1.02 REFERENCE STANDARDS

- A. UL 507 - Electric Fans Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 507.
- B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 HIGH-VOLUME, LOW-SPEED PROPELLER FANS

- A. Manufacturers:
 - 1. Sky Blade.
 - 2. Big Ass Fans.
 - 3. Macro Air
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Shafts and Bearings:
 - 1. Fan Shaft:
 - a. Ground and polished steel with anti-corrosive coating.
 - b. First critical speed at least 25 percent over maximum cataloged operating speed.
 - 2. Bearings:
 - a. Permanently sealed or pillow block type.
 - b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - c. 100 percent factory tested.
- C. Accessories:

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure fan with stainless steel lag screws to structure.

END OF SECTION 233439

**SECTION 233516
ENGINE EXHAUST SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Multi-Gas detection system
- B. Vehicle Exhaust system

1.02 RELATED REQUIREMENTS

- A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

PART 2 PRODUCTS

2.01 GAS DETECTION SYSTEM

- A. Manufacturers:
 - 1. Honeywell; Honeywell Analytics: www.honeywellanalytics.com
 - 2. Other manufacturers are permitted to bid these specifications upon engineer's approval.
- B. E3 Point Toxic and Combustible Gas Detector (Standalone)
 - 1. System shall be able to control the two bay exhaust fans and the motorized louver.
 - 2. Normal (lower cfm) exhaust fan shall operate continuously any time the building is occupied. Upon activation of the system sensors the higher cfm fan shall be activated and the motorized louver shall open. When the system levels are back to the safe range the higher cfm fan shall be deactivated and the motorized louver shall close.
 - 3. Provide sensor quantity and type as recommended by the equipment manufacturer for the space installed.
- C. Wall or duct-mounted gas detector for monitoring the following:
 - 1. carbon monoxide (CO)
 - 2. nitrogen dioxide (NO₂),
 - 3. Installed as a standalone device with single-gas or dual-gas monitoring
- D. Power Requirement: 24 Vac nominal (17-27Vac), 50/60 Hz, 0.35 A; 24Vdc nominal (20-38Vdc); with remote sensor: 7 W max
- E. Relay Output: 2 DPDT relays, 5A @ 250Vac; 5A @ 30Vdc
- F. Operating Environment: Commercial, Indoor, Extreme Temperature Environments
- G. Operating Temperature:
 - 1. H₂S, NO₂, O₂, CH₄, H₂, C₃H₈: -40 to 50°C (-40 to 122°F)
 - 2. CO: -20 to 50°C (-4 to 122°F)
- H. Sensor Type: Electrochemical cell (CO, NO₂, H₂S, O₂); catalytic (CH₄, H₂, C₃H₈,)
- I. Response Time: T₉₀ < 50 seconds, With ECLAB T₉₀ < 240 seconds.
- J. Display: 8 character, 2 line backlit LCD
- K. Visual Indicators:
 - 1. Green LED: Power
 - 2. Amber LED 1: Alarm/Fault
 - 3. Amber LED 2: Alarm/Fault
- L. Audible Alarm: >85 dBA at 3 m (10 ft)
- M. Accuracy: ± 3% of full scale @ 25°C
- N. Detection Ranges and Alarm Levels:

GAS	RESOLUTION	RANGE	ALARM A	ALARM B	ALARM C
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Lee's Summit, Missouri

CO (Carbon Monoxide)	1 ppm	0-250 ppm	25 ppm	100 ppm	225 ppm
NO2 (Nitrogen Dioxide)	0.1 ppm	0-10 ppm	0.7 ppm	2 ppm	9 ppm

- O. Enclosure: Polycarbonate
- P. Certification: CSA C22.2 No. 61010-1, UL 61010-1; FCC part 15; ICES-003 issue 4; ISO 9001-2008

2.02 ENGINE EXHAUST REMOVAL SYSTEM

- A. Manufacturer: Air Vacuum Corporation
 - 1. Contact: P.O. Box 0517; Dover, NH 03821-0517; Phone: 800-540-7264; 603-743-4332; Fax: 603-743-3111; Email: sales@airvacuumcorporation.com; Website: www.airvac911.com
- B. Air Vacuum Corporation, AIRVAC 911: Self-contained, fully automatic, recirculating, hoseless system with vertical intake and 360 degree horizontal clean air output; designed to remove hazardous gases and particulate from indoor vehicle parking bays and eliminate exhaust backwash in accordance with ANSI/ASHRAE 52.2, UL 508A, UL 900, ULC/CAN S111 and NFPA 1500.
- C. Description: Multiple zone system with total number of 6 units, as shown on drawings.
- D. Components:
 - 1. Cabinet body: Includes 4 pre-drilled mounting holes and 4 2 inch × 2 inch × 3/16 inch (51 mm × 51 mm × 4.8 mm) thick mounting angles for chain suspension or threaded-rod hangers; 8 feet (2438 mm) 3-prong, 14 gauge pre-molded electrical cord; 4 adjustable airflow grilles; 2 hinged access panels with 1 panel on top for access to motor blower unit and 1 panel on bottom for access to filter compartment; automated filter replacement gauge and electrical connection box.
 - a. Material and finish: 18 gauge steel with gray powder coat finish.
 - b. Cabinet height: 28 inch.
 - c. Overall height: 34 9/16 inch.
 - d. Width: 26 inch.
 - e. Depth: 24 5/8 inch.
 - f. Weight: 190 lb with filter material; 135 lb without filter material.
 - 2. Filters:
 - a. Pre-Filter: 24 inch × 24 inch × 1 inch (610 mm × 610 mm × 25 mm); 3 ply polyester construction; self-sealing; meeting requirements for Class 2 in accordance with UL 900 and ULC/CAN S111. Certified efficiency of 30 to 35 percent based on ASHRAE 52.2 test method.
 - b. Main Media Filter: 24 inch × 24 inch × 6 inch (610 mm × 610 mm × 152 mm); HEPA MAX 3000 high efficiency particulate air filter, with ultra-fine pleated fiberglass media pack; constructed with 24 gauge galvanized metal frame and corrugated aluminum dividers between pleats; meeting requirements for Class 2 in accordance with UL 900 and MERV 16. Certified efficiency of 95 to 99.97 percent based on dioctyl phthalate (DOP) testing with 0.3 micrometer particles. Maximum filter media weight is 16 lb (7.3 kg) for main filter.
 - c. Gas-Phase Extractor: 24 inch × 24 inch × 4 inch (610 mm × 610 mm × 102 mm) deep; 2-part gas phase extractor with activated carbon filter for removal of heavy weight gases and potassium permanganate filter for removal of light weight gases. Heavy and light weight filters are each constructed with 24 gauge galvanized metal frame and honeycomb containment structure. Maximum filter media weight is 28 lb (12.7 kg) for both gas-phase filters.

3. Motor-Blower Unit: Dual voltage, ball bearing, resilient mounted, capacitor start, thermally protected, UL approved electric motor; with plastic chemical resistant, back curved, 14 inch × 7 33/64 inch (356 mm × 191 mm) centrifugal impeller and airflow funnel cone.
 - a. Motor: 3/4 HP, 115/208-230 V, 1 phase, 50-60 Hz, 13/6.3 to 6.5 FLA.
4. Automatic Vehicle Exhaust Control System (AVEC), Model AVEC-6C/T2: NEMA 4, 120V electrical controller designed to operate and sequentially activate exhaust removal units in groups of two, after 15 second delays, until all units are activated, including: adjustable low voltage time delay relay; LED "System Activated" indication light; ON-OFF- AUTO selector, "System Test" switch to activate system for a timed cycle; 120 V to 24 V, 2A low voltage transformer to power system activation devices; meeting UL 508 for industrial enclosed control panels.
5. System Activation Devices
 - a. Standard magnetic door switches and photoelectric eye switches.
 - b. Manual push buttons.
6. Installation: Ceiling-hung with chain or threaded rod, between vehicle bays as detailed on the drawings. Power is required to each unit through the AVEC electrical controller. Low-voltage wiring and connections are necessary for activation devices.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- C. Accurately fit, align, securely fasten and install free from distortion or defects.
- D. Test, adjust and balance for proper operation.
- E. Clean, lubricate and adjust moving parts.

END OF SECTION 233516

**SECTION 233700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
 - 1. Rectangular ceiling diffusers.
 - 2. Slot ceiling diffusers.
- B. Registers/grilles:
 - 1. Ceiling-mounted, exhaust and return register/grilles.
 - 2. Ceiling-mounted, supply register/grilles.
 - 3. Wall-mounted, supply register/grilles.
 - 4. Wall-mounted, exhaust and return register/grilles.
- C. Duct-mounted supply and return registers/louvers.
- D. Louvers:
 - 1. Combination louvers.
- E. Gravity ventilators.

1.02 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.
- B. Krueger-HVAC: www.krueger-hvac.com/#sle.
- C. Price Industries: www.price-hvac.com/#sle.
- D. Ruskin Company: www.ruskin.com/#sle.
- E. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

2.02 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square, stamped, multi-core diffuser to discharge air in four way pattern with sectorizing baffles where indicated.
- B. Connections: Round.
- C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- D. Fabrication: Steel with baked enamel finish.

2.03 CEILING SLOT DIFFUSERS

- A. Type: Continuous 3/4 inch wide slot, two slots wide, with adjustable vanes for left, right, or vertical discharge.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket, mitered end border.
- C. Plenum: Integral, galvanized steel, insulated.

2.04 DUCT-MOUNTED SUPPLY AND RETURN REGISTERS/LOUVERS

- A. Type: Duct-mounted, rectangular register for round-spiral duct with adjustable pivot-ended blades, end caps, built-in volume damper, and dual cover flanges to lay flush on duct surface regardless of diameter. Performance to match manufacturer's catalog data.
- B. Material: 22 gauge, 0.0299 inch.

2.05 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

2.06 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

2.07 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

2.08 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel frames and blades, with factory baked enamel finish.
- D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.09 LOUVERS

- A. Manufacturers:
 - 1. Ruskin Company: www.ruskin.com/#sle.
 - 2. Greenheck.
 - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Type: 4 inch deep frame with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over intake or exhaust end.

2.10 COMBINATION LOUVERS

- A. Manufacturers:
 - 1. Ruskin Company: www.ruskin.com/#sle.
 - 2. Greenheck.

2.11 GRAVITY VENTILATORS

- A. Spun Aluminum Intake Gravity Ventilator:
 - 1. Manufacturers:
 - a. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - b. Loren Cook Company: www.lorencook.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.

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Lee's Summit, Missouri

2. General:
 - a. Provide low silhouette configuration for intake applications with natural gravity or negative pressure system.
3. Hood:
 - a. Material: Aluminum.
4. Birdscreen:
 - a. Fabricate in accordance with ASTM B221 (ASTM B221M).
 - b. Construction: 1/2 inch galvanized mesh.
5. Options/Accessories:
 - a. Roof Curbs:
 - 1) Flat Roofs:
 - (a) Welded, straight side curb with flashing flange and wood nailer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

END OF SECTION 233700

**SECTION 235216
CONDENSING BOILERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured units.
- B. Boiler construction.
- C. Boiler trim.
- D. Fuel burning system.
- E. Factory installed controls.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.
- B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2021.
- D. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI) Current Edition.
- E. NFPA 54 - National Fuel Gas Code 2021.
- F. SCAQMD 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters 1990, with Amendment (2018).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Natural Gas, Propane, or Combination Natural Gas/Propane for Indoor Applications:
 - 1. LAARS Heating Systems Company: www.laars.com/#sle.
 - 2. Lochinvar LLC: www.lochinvar.com/#sle.
 - 3. Aerco.

2.02 MANUFACTURED UNITS

- A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.
- B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

2.03 BOILER CONSTRUCTION

- A. Comply with the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.
- B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1 I-P.
- C. Required Directory Listings:
 - 1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.
 - 2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.
- D. Heat Exchanger: Construct with materials that are impervious to corrosion where subject to contact with corrosive condensables.
- E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.
- F. Insulate casing with insulation material, protected and covered by heavy-gauge metal jacket.
- G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, or weather-proofed finish.

2.04 BOILER TRIM

- A. ASME rated pressure relief valve.
- B. Flow switch.
- C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.
- D. Temperature and pressure gauge.
- E. Pressure Switches:
 - 1. High gas pressure.
 - 2. Low gas pressure.
 - 3. Air pressure.
- F. Manual reset high limit.
- G. Boiler Pump (where required by boiler design):
 - 1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.
 - 2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.
 - 3. Pump time delay.

2.05 FUEL BURNING SYSTEM

- A. Provide forced draft automatic burner or pulse combustion, integral to boiler, designed to burn natural gas, propane, and No. 2 fuel oil, and maintain fuel-air ratios automatically.
 - 1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.
 - 2. Forced Draft Design: Mixes combustion air and gas to achieve 90 percent combustion efficiency.
 - 3. Pulse Combustion Design: Self-aspirating, not requiring blower for combustion.
 - 4. Combustion Air Filter: Protects fuel burning system from debris.

- B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.
- C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.
- D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe.

2.06 FACTORY INSTALLED CONTROLS

- A. Option for internal or external (0-10) VDC control.
- B. Temperature Controls:
 - 1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.
 - 2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
 - 3. Low-fire start time delay relay.
- C. Electronic PI setpoint/modulation control system.
- D. Microprocessor-based, fuel/air mixing controls.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.
- C. Install boiler on concrete housekeeping base, unless noted otherwise, sized minimum of 4 inches larger than boiler base in accordance with Section 033000.

3.02 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.

END OF SECTION 235216

SECTION 237223
PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Energy recovery units.
- B. Casing.
- C. Fans.
- D. Total energy wheel.
- E. Filters.
- F. Dampers.
- G. Roof curbs.
- H. Power and controls.

1.02 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).
- C. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment 2018.
- D. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).
- E. ASHRAE Std 84 - Method of Testing Air-to-Air Heat/Energy Exchangers 2020, with Errata (2021).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- I. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.
- C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Energy Recovery Ventilators:
 - 1. RenewAire: www.renewaire.com/#sle.

2. Ruskin Company: www.ruskin.com/#sle.
3. Trane.
4. Aaon
5. Substitutions: See Section 016000 - Product Requirements.

2.02 ENERGY RECOVERY UNITS

- A. Energy Recovery Units: Provide dessicant wheel type or stationary core air-to-air exchanger; prefabricated packaged system designed by manufacturer.
 1. Provide unit with a AHRI 1060 (I-P) compliant air-to-air exchanger.
 2. Access: Hinged and/or screwed access panels on front.
 3. Framing: Welded extruded aluminum tubular frame capable of supporting components and casings.
 4. Permanent name plate listing manufacturer mounted inside door near electrical panel.
- B. Inline Supply Fan:
 1. Construction: Galvanized steel and insulated housing.
 2. Plastic components to comply with UL 94.

2.03 CASING

- A. Wall, Floor, and Roof Panels:
 1. Construction: 1 inch thick, double wall box construction, with formed edges of exterior wall overlapping formed edges of interior wall.
 2. Exterior Wall: Galvanized steel sheet.
 - a. 0.040 inches thick aluminum.
 3. Interior Wall: Galvanized sheet metal.
 - a. 22 gauge, 0.0299 inch galvanized sheet metal.
 4. Insulation:
 - a. 1/2 inch insulated fiberglass.
 - b. Panel Cores: Mineral wool board.
 - c. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
 - d. Smoke Developed Index (SDI): 50, maximum, when tested in accordance with ASTM E84 or UL 723.
 5. Roof Panel: Weatherproof.
 6. Coating: Polyurethane enamel.
- B. Access Panels: Provide access to components through a large, tightly sealed and easily removable panel.
- C. Doors:
 1. Construct doors of same construction and thickness as wall panels.
 2. Height: 80 inches.
- D. Weather Hood: Provide on fresh air inlet and exhaust air outlet; removable for access.
 1. Fresh Air Weather Hood: Maintain a face velocity less than 340 feet/min.

2.04 FANS

- A. Provide separate fans for exhaust and supply blowers.
- B. Fans:
 1. Individually driven with a dedicated motor.
 2. AMCA-rated.

- C. Housings: 12 gauge, 0.1046 inch aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.
- D. Motors:
 - 1. Motors: Open drip proof.
 - 2. Efficiency: High.
 - 3. Speed: Single.
 - 4. Control: Constant Speed.
 - 5. Fan Motor: UL listed and labeled.
- E. Drives:
 - 1. Fans: Belt driven.
 - 2. Horsepower: 7.5 hp.
 - 3. Service Factor: 1.2.

2.05 TOTAL ENERGY WHEEL

- A. Wheel: Transfer heat and humidity from one air stream to the other with minimum carryover of the exhaust air into the supply air stream.
- B. Sensible Recovery Efficiency: [_____].
- C. Latent Recovery Efficiency: [_____].
- D. Wheel Effectiveness: Rated in accordance with ASHRAE Std 84 and AHRI 1060 (I-P).
- E. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84 or UL 723.
- F. Smoke Developed Index (SDI): 50 or less, when tested in accordance with ASTM E84 or UL 723.
- G. Energy Recovery Wheel Media Face:
 - 1. Comply with NFPA 90A.
- H. Rotor:
 - 1. Type: Non-segmented hygroscopic aluminum wheel.
 - 2. Rotor Matrix: Corrosion resistant aluminum alloy composed of alternating corrugated and flat, continuously wound layers of uniform widths.
- I. Desiccant:
 - 1. Type: 3A.
- J. Drive:
 - 1. Drive: Tensioned drive with full perimeter link style belt.

2.06 FILTERS

- A. Thickness: 2 inch.
- B. Efficiency: 8 MERV.
- C. Exhaust and Fresh Air Streams: MERV 7 filters constructed to meet ASHRAE Std 52.2.
- D. Mount 1/2-inch thick, permanent, aluminum, washable type filter in outside air hood and in return air plenum.

2.07 DAMPERS

- A. Exhaust Back-Draft Damper: Factory installed, galvanized steel.
 - 1. High performance, backdraft dampers suitable for application in HVAC systems with velocities to 3000 fpm.
 - 2. Louvers, Dampers, and Shutters: AMCA 500-D and AMCA 500-L.

3. Damper Capacity: Demonstrate damper capacity to withstand HVAC system operating conditions.
 4. Fabrication:
 - a. Frame: 20 gauge, 0.0359 inch, 3 inch roll formed galvanized steel channel with rear flange, prepunched mounting holes, and welded corner clips for maximum rigidity.
 - b. Blades:
 - 1) Style: Single-piece, overlap frame.
 - 2) Material: Roll formed 28 gauge, 0.0149-inch galvanized steel.
 - 3) Width: Maximum 6 inches.
- B. Return Air Damper:
1. Factory installed, adjustable volume control, opposed blade damper for regulating airflow, based on external static pressure.
 2. Return Air Damper: Structural hat channels, reinforced at corners.
 3. Roll-formed Frames: Structurally superior to 13 gauge, 0.0897 inch U-channel frames.
 4. Blades: Single skin, 16 gauge, 0.0598 inch.
- C. Motorized Dampers: Provide motorized dampers at outside air inlet, exhaust air outlet, and supply air outlet.
1. Type: Motorized two position parallel blade damper with blade seals.
 2. Motorized Damper: Roll-formed structural hat channels, reinforced at the corners,
 3. Blades: Single skin, 16 gauge, 0.0598 inch.
- D. Motorized Louvers:
1. Type: Motorized two position parallel blade louver with drainable blades, blade seals, and jamb seals
 2. Adjustable louver:
 - a. Fabrication: Mullion style.
 - 1) Frame:
 - (a) Material: Extruded aluminum, Alloy 6063-T5.
 - 2) Blades:
 - (a) Style: Horizontal, adjustable, drainable.
 - (b) Material: Formed aluminum, Alloy 6063-T5.

2.08 ROOF CURBS

- A. Curbs: Provide full perimeter insulated roof curb fabricated from 10 gauge, 0.1345 inch aluminized steel.

2.09 POWER AND CONTROLS

- A. Motor Control Panels: UL listed.
- B. Include necessary motor starters, fuses, transformers and overload protection according to NFPA 70.
- C. Install wiring in accordance with NFPA 70.

PART 3 EXECUTION

3.01 INSTALLATION

3.02 SYSTEM STARTUP

- A. Provide services of manufacturer's authorized representative to provide start up of unit.

END OF SECTION 237223

**SECTION 237433
DEDICATED OUTDOOR AIR UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted DOAS.

1.02 RELATED REQUIREMENTS

- A. Section 230513 - Common Motor Requirements for HVAC Equipment.
- B. Section 230934 - Variable-Frequency Motor Controllers.
- C. Section 251400 - Integrated Automation Local Control Units.
- D. Section 251500 - Integrated Automation Software: BAS, BMS, or SCADA.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment 2015, with Addendum.
- C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
- D. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units 2022.
- E. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL (DIR) - Online Certifications Directory Current Edition.
- H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. CaptiveAire Systems: www.captiveaire.com/#sle.
- B. Greenheck: www.greenheck.com/#sle.
- C. York a brand of Johnson Controls International, Plc: www.york.com/#sle.
- D. Aaon
- E. Substitutions: See Section 016000 - Product Requirements.
- F. Basis of Design: RuppAir

2.02 ROOF-MOUNTED DOAS

- A. Packaged Unit:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Casing and Components:
 - a. Fabrication: AHRI 210/240 and UL 207 construction, ASHRAE Std 23 tested.
 - b. 18 gauge, 0.0478 inch steel panels reinforced with structural angles and channels to ensure rigidity.
 - c. Provide bolted access panels to access each sections from either side of unit.
 - d. Provide hinged door with lockable handle for serviceable sections.
 - e. Drain Pan: Galvanized steel with corrosion-resistant coating.
 2. Performance Ratings: ASHRAE Std 90.1, EER and COP as applicable.
 3. Regulatory Requirements: AHRI 270 rated, NFPA 70, and UL (DIR) listed.
 4. Insulation: Minimum 1/2 inch thick acoustic duct liner for lining cabinet interior.
 5. External Surface Finish: Heat resistant baked enamel.
 6. Outdoor Installation: Weatherproofed casing, with intake louver or hood.
 7. Outside Air Damper with Rain Hood and Screen:
 - a. Set outdoor air dampers to fully open when fan starts and close 30 seconds after fan stops, adjustable.
- B. Filter Section:
1. Filter: Removable, 2 inches thick combined MERV-8 and MERV-14.
- C. Heating Section:
1. Indirect Gas-Fired Furnace:
 - a. Insulation: Neoprene faced glass fiber insulation, 1 inch thick, on inlet components to burner profile plate.
 - b. Observation Port: On burner section for observing main and pilot flames.
 - c. Pilot: Electrically ignited by spark rod through high voltage ignition transformer.
 - d. Damper: Motorized with end switch to prove position before burner will fire.
- D. Cooling Section:
1. Packaged DX Cooling:
 - a. Configuration: AHRI 520 rated, R-410a refrigerant system with hot gas bypass.
 - b. Evaporator Coil: Copper tube aluminum fin coil assembly with alternate row circuiting, and with galvanized drain pan and thermostatic expansion valve.
 - c. Compressor: One hermetic single-stage scroll or reciprocating, 3,600 rpm maximum resilience with positive lubrication, crankcase heater, high pressure control, low pressure control, motor overload protection, service valves and dryer.
 - d. Condenser Side: Aluminum fin and copper tube coil, direct drive axial fan resiliently mounted, galvanized fan guard. ECM condenser fans.
 - e. Operating and Safety Controls: Internally coordinated with main unit controls.
- E. Enthalpy Economizer Section: Provide factory-installed sensors, electrically-actuated return air damper, and electrically-actuated exhaust damper fully coordinated with return, exhaust, or return-exhaust fan section. Configure controls for fault-detection diagnostics.
- F. Fan Section:
1. Provide direct or plenum mounted variable-speed fan motors; see Section 230513.
 2. Draw-through, forward-curved fan, constructed of corrosion-resistant, galvanized material and designed for efficient, quiet operation.
 3. Factory program for both soft start and constant flow output over static pressure range.
 4. Provide preinstalled neutral wire protection when required to support specified fan type.
 5. Motor to include thermal overload protection, quick disconnect plug, and permanently lubricated bearings.
 6. Belt-Driven Motor Requirements: Provide adjustable blower motor/sheave combination device based on indicated flow performance requirements. Statically and dynamically

- balanced centrifugal fan mounted on solid steel shaft with heavy-duty, self-aligning, prelubricated ball bearings and V-belt drive with matching motor sheaves and belts.
- 7. Variable Speed Control: Configure controller to maintain adjustable flow setpoint for modulating or speed-switched units; see Section 230934.
- 8. Fan Turndown: Design control features to allow fan speed reduction to adjustable 50 percent of its capacity when the zone set point temperature is satisfied or when unit runs in fan-only mode.
- G. Unit Controls:
 - 1. DDC:
 - a. Application Specific Controller; see Section 251400 unless factory-provided.
 - b. Tested to monitor and handle sequencing functions and other operational modes using field-mounted thermostat and other sensors.
 - c. Coordination and Sequencing:
 - 1) Internal Devices: Include compressors, blower, sensors, switches, valves, safeties, other components.
 - 2) Field-Installed Devices: Solenoid valves, thermostat, EWT sensors, LWT sensors, internal and remote contacts, and other devices required for operation.
 - 3) Safeties: At minimum include anti-short-cycle compressor protection, condensate overflow, refrigerant high pressure, refrigerant low pressure, loss-of-charge, refrigerant freeze protection, and freezestat.
 - 2. Thermostat:
 - a. Field mounted and wired, tied into prewired control-interface terminals.
 - b. Smart Thermostat:
 - 1) BAS, SCADA, or Integrated Automation linked programmable thermostat; see Section 251400.
 - c. Programmable Thermostat:
 - 1) Electro-mechanical type with key- or pushbutton-operated display.
 - 2) Programmable occupied/unoccupied weekly and holiday schedule.
 - d. Nonprogrammable Thermostat:
 - 1) Electro-mechanical type with key- or pushbutton-operated display.
 - 2) User-configurable, precoded options aligned with equipment functions.
 - e. Thermostat: Single-gang-box-mounted platinum or thermistor.
 - 1) Local Interface to Include:
 - (a) Filter maintenance indicating status.
 - 3. Local Control Panel: Interface to include on-off-auto switch, summer-winter switch, heat-off-cool switch, indicating lights for supply fan, pilot operation, burner operation, lockout indication, and clogged filter indication.
- H. Electrical: 208 VAC, 3-phase, 60 Hz, single point to factory-mounted nonfused disconnect switch internally wired into motors and compressors, and other powered components including system safeties.
- I. Furnish dedicated outdoor air unit and associated components and accessories produced by a single manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Connect drain pan outlet to nearest building drain system piping.
- C. Adjusting: Use plenum static pressure readings against manufacturer calibration chart to adjust primary airflow as other measuring methods will not work.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- D. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface; see Section 25 1500.

END OF SECTION 237433

SECTION 238129
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source outdoor units.
- B. Refrigerant piping.
- C. Refrigerant branch units.
- D. Indoor units.

1.02 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
- B. AHRI 1230 - Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment 2021.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
- E. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks 2020, with Errata and Amendments (2022).
- F. ITS (DIR) - Directory of Listed Products Current Edition.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Pre-Bid Submittals: For proposed substitute systems/products, as defined in PART 2, and alternate systems/products, as defined above, proposer shall submit all data described in this article, under the terms given for substitutions stated in PART 2.
- C. Product Data: Submit manufacturer's standard data sheets showing the following for each item of equipment, marked to correlate to equipment item markings indicated in Contract Documents:
 - 1. Outdoor Units:
 - a. Refrigerant Type and Size of Charge.
 - b. Output and Input Cooling Capacity: Btu/h.
 - c. Output and Input Heating Capacity: Btu/h.
 - d. Operating Temperature Range, Cooling and Heating.
 - e. Fan Capacity: Flow in cfm with respective fan curves.
 - f. External Static Pressure (ESP): In-wc.
 - g. Sound Pressure Level: dB(A).
 - h. Electrical Data: Complete including motor size.
 - i. Maximum number of indoor units that can be served.
 - j. Maximum refrigerant piping run from outdoor unit to indoor unit(s).

- k. Maximum height difference between outdoor unit to Indoor unit(s), both above and below.
- 2. Indoor Units:
 - a. Output and Input Cooling Capacity: Btu/h.
 - b. Output and Input Heating Capacity: Btu/h.
 - c. Fan Capacity: Flow in cfm with respective fan curves.
 - d. External Static Pressure (ESP): In-wc.
 - e. Electrical Data: Complete including motor size.
 - f. Maximum Lift of Built-in Condensate Pump.
- 3. Control Panels: Complete data of controllers, input-output points, and zones.
- D. Shop Drawings: Installation drawings custom-made for this project; include as-designed HVAC layouts, locations of equipment items, refrigerant piping sizes and locations, condensate piping sizes and locations, remote sensing devices, control components, electrical connections, control wiring connections. Include:
 - 1. Detailed piping diagrams, with branch balancing devices.
 - 2. Condensate piping routing, size, and pump connections.
 - 3. Detailed power wiring diagrams.
 - 4. Detailed control wiring diagrams.
 - 5. Locations of required access through fixed construction.
 - 6. Drawings required by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. LG Electronics U.S.A., Inc: www.lghvac.com/#sle.
- B. Mitsubishi Electric Trane HVAC US, LLC: www.metahvac.com/#sle.
- C. Samsung.
- D. Lennox
- E. Substitutions: Systems designed and manufactured by other manufacturers will be considered by Owner under the terms described for substitutions with the following exceptions:
 - 1. Substitutions: See Section 016000 - Product Requirements.
 - 2. Substitution requests will be considered only if received at least 10 days prior to the bid date.
 - 3. Substitution requests will be considered only if submitted data meets or exceed requirements listed in this section.
 - 4. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
 - 5. Contractor or HVAC subcontractor shall certify that the substitute system will achieve the performance specified.
 - 6. Do not assume substitution has been accepted until formal written notice has been issued by Engineer.

2.02 VARIABLE REFRIGERANT FLOW SYSTEM

- A. Minimum System Requirements:
 - 1. System Testing, Capacity Rating, and Performance:
 - a. AHRI 1230 when cooling capacity is equal or greater than 65,000 Btu/h.
 - b. AHRI 210/240 when cooling capacity is below 65,000 Btu/h.
 - 2. Safety Certification: Bear UL 1995 tested and ITS (DIR) listed certification label.

3. Outdoor Units: Furnish installation and surface support hardware products in accordance with ASCE 7 for wind restraint.
4. Cooling Mode Interior Performance:
 - a. Daytime Setpoint: 68 degrees F, plus or minus 2 degrees F.
 - b. Setpoint Range: 57 degrees F to 77 degrees F.
 - c. Night Setback: 78 degrees F.
 - d. Interior Relative Humidity: 20 percent, maximum.
- B. System Design and Installation Considerations:
 1. Conditioned spaces and zones are indicated on drawings.
 2. Outside unit locations are indicated on drawings.
 3. Indoor unit locations are indicated on drawings.
 4. Branch refrigerant unit locations are indicated on drawings.
 5. Required equipment unit capacities are indicated on drawings.
 6. Refrigerant piping sizes are not indicated on drawings.
 7. Condensate piping to nearest drain is indicated on drawings.
 8. Provide calculations showing ASHRAE Std 15 guideline compliance.

2.03 AIR-SOURCE OUTDOOR UNITS

- A. Heat Pump Type:
 1. DX refrigeration unit piped to one or more compatible indoor units either directly or indirectly through one or more intermediate refrigeration branch units.
 2. Manifold two or to three units as recommended by manufacturer to handle sequencing and coordination of multiple indoor units.
- B. Unit Cabinet:
 1. Capable of being installed with wiring and piping to the left, right, rear or bottom.
 2. Designed to allow side-by-side installation with minimum spacing and vibration isolation.
 3. Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
 4. Sound Pressure Level: 55 dB measured at 3 feet from front of unit.
- C. Heat Sink Side:
 1. Condenser Fans:
 - a. Provide minimum of 2 fans for each condenser within the outdoor unit.
 - b. Minimum External Static Pressure: Factory set at 0.12 in-wc.
 - c. Fan Type: Vertical discharging, direct-driven propeller type with variable speed operation using DC-controlled ECM motors mechanically connected using permanently lubricated bearings having whole assembly protected with fan guards.
 2. Condenser Coils:
 - a. Hi-X seamless copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.
- D. Refrigeration Side:
 1. Factory assembled and wired with instrumentation, switches, and controller(s) to handle unit specifics with direct coordination of remote controller(s) from indoor unit(s).
 2. Refrigeration Circuit: ECM driven dual scroll compressors, fans, condenser heat sink coil, expansion valves, solenoid valves, distribution headers, capillaries, filters, shutoff valves, oil separators, service ports, and refrigerant regulator.
 3. Refrigerant: R-410a factory charged. Controller to alarm when charge is below capacity.
 4. Variable Volume Control: Modulate compressed refrigerant capacity automatically to maintain constant suction and condensing pressures under varying refrigerant volume

- required to handle remote loads. Include defrost control.
- 5. Provide refrigerant subcooling to ensure the liquid refrigerant does not flash when supplying to use indoor units.
- 6. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle, oil return, or defrost is not permitted due to potential reduction in space temperature.
- 7. Power Failure Mode: Automatically restarts operation after power failure without loss of programmed settings.
- 8. Safety Devices: High pressure sensor with cut-out switch, low pressure sensor with cut-out switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, overcurrent protection for the inverter and antirecycling timers.
- 9. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
- E. Local Controls:
 - 1. Include factory-wired instruments, sensors, switches, and safeties for unit control.
 - 2. Configured to coordinate internal unit operation with remote indoor units and with built-in capacity to coordinate other manifolded outdoor units and remote refrigerant branch unit(s).
 - 3. Include screen and button interface to setup operating schedules, setpoints, alarms, and remote unit setpoint coordination. Also used for system troubleshooting.
 - 4. Self diagnostic, auto-check functions to detect malfunctions and display the type and location.
- F. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet IP.
- G. Power:
 - 1. Electrical Requirement: 208 to 230 VAC, 3-phase, 60 Hz.
 - 2. Outdoor Mounted: Provide fused NEMA 250 Type 4X disconnect switch.

2.04 REFRIGERANT PIPING

- A. Two-Pipe Run: Provide low-pressure vapor and high-pressure vapor gas pipes for each indoor unit selected for seasonal heating or cooling service.
- B. Three-Pipe Run: Provide low-pressure vapor, high-pressure vapor gas, and liquid pipes for each indoor unit selected for off-season heating and cooling changeover service.
- C. Refrigerant Flow Balancing: Provide refrigerant piping joints and headers specifically designed to ensure proper refrigerant balance and flow for optimum system capacity and performance; T-style joints are prohibited.

2.05 REFRIGERANT BRANCH UNITS

- A. Outdoor unit interface to handle two or more indoor units required to do automatic off-season heating and cooling changeover.
- B. Concealed box consisting internally-piped refrigeration loops, subcooling heat exchanger, and other devices coordinated by electronic valves to facilitate off-season load management between outdoor and indoor units.
- C. Minimum Requirements:
 - 1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.

2. Provide one electronic expansion valve for each downstream indoor unit served except when multiple indoor units are connected, provide balancing joints in downstream piping to keep total capacity within branch unit capacity.
3. Energize subcooling heat exchanger during simultaneous heating and cooling service.
4. Casing: Galvanized steel sheet with flame and heat resistant foamed polyethylene sound and thermal insulation.
5. Refrigerant Connections: Braze type.
6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.06 INDOOR UNITS

- A. Manufacturers:
- B. Minimum Unit Requirements:
 1. DX Evaporator Coil:
 - a. Copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
 - b. 2-, 3-, or 4-row cross fin design with 14 to 17 fins per inch and flare end-connections.
 - c. Provide thermistor on liquid and gas lines wired into local controller.
 - d. Refrigerant circuits factory-charged with dehydrated air for field charging.
 2. Fan Section:
 - a. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
 - b. Thermally protected, direct-drive motor with statically and dynamically balanced fan blades.
 - c. Minimum-adjustable external static pressure 0.32 in-wc; provide for mounting of field-installed ducts.
 3. Local Unit Controls:
 - a. Temperature Control: Return air control using thermistor tied to computerized Proportional-Integral-Derivative (PID) control of superheat.
 - b. Temperature Zones:
 - 1) Single Indoor Unit: Set served space(s) as the local temperature zone.
 - 2) Multiple Indoor Units: For large zones, group and coordinate related indoor units with served spaces as the local temperature zone with each indoor unit as sub-zone.
 4. Return Air Filter:
 5. Condensate:
 - a. Built-in condensate drain pan with PVC drain connection for drainage.
 - b. Units With Built-In Condensate Pumps: Provide condensate safety shutoff and alarm.
 - c. Units Without Built-In Condensate Pump: Provide built-in condensate float switch and wiring connections.
 6. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.
- C. Ceiling-Recessed Cassette, Indoor Units:
 1. Ceiling mount, 4-way, 2-way, or 1-way supply air flow units with central return air grill, DX coil, tubed drain pan, and built-in controls with thermostat remotely coordinated by outdoor air unit to maintain local air temperature setpoint.
 2. Cabinet Height: Maximum of 10 inches above face of ceiling.
 3. Exposed Housing: White, impact resistant, with washable decoration panel.
 4. Supply Airflow Adjustment:
 - a. Horizontally and vertically adjustable dampers with electronic actuators.

- b. Four-way distribution field-modifiable to 3-way and 2-way airflow.
 - c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
- 5. Return Air Filter: Manufacturer's standard.
- 6. Sound Pressure Range: Between 28 to 33 dB(A) at low speed measured at 5 feet below the unit.
- 7. Fan: Direct-drive turbo type, with motor output range of 1/16 to 1/8 hp.
- 8. Condensate Pump: Built-in with minimum lift of 21 inches.
- 9. Fresh Air Intake: Provide side-mounted outdoor air intake duct connection.
- D. Ceiling-Concealed Ducted Indoor Units:
 - 1. Type: Ducted unit with DX coil, tubed drain pan, and built-in controls with thermostat remotely coordinated by outdoor air unit to maintain local air temperature setpoint.
 - 2. Ducted horizontal discharge and side or back-end return; galvanized steel cabinet.
 - 3. Variable or three-speed ECM fan with automatic airflow adjustment; external static pressure selectable during commissioning.
 - 4. Return Air Filter: Manufacturer's standard.
 - 5. Sound Pressure: Measured at low speed at 5 feet below unit.
 - 6. Provide external static pressure switch adjustable for high efficiency filter operation
 - 7. Condensate Pump: Built-in, with lift of 9 inches, minimum.
 - 8. Switchbox accessible from side or bottom.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install refrigerant piping in accordance with equipment manufacturer's instructions.
- C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
- D. Coordinate with installers of systems and equipment connecting to this system.

3.02 SYSTEM STARTUP

- A. Prepare and start equipment and system in accordance with manufacturer's instructions and recommendations.
- B. Adjust equipment for proper operation within manufacturer's published tolerances.

3.03 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, and maintenance of each component.

3.04 PROTECTION

- A. Protect installed components from subsequent construction operations.
- B. Replace exposed components broken or otherwise damaged beyond repair.

END OF SECTION 238129

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Oxide inhibiting compound.
- F. Wire pulling lubricant.
- G. Cable ties.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers 2005 (Reapproved 2021).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation 2018.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- I. NECA 104 - Standard for Installing Aluminum Building Wire and Cable 2012.
- J. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable 2018.
- K. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- L. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- O. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

- P. UL 267 - Outline of Investigation for Wire-Pulling Compounds Most Recent Edition, Including All Revisions.
- Q. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- R. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- S. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- T. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.
- U. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless

specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.

- a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
 - 1) Services: Copper conductors size 1/0 AWG and larger.
 - 2) Feeders: Copper conductors size 1/0 AWG and larger.
 - b. Where aluminum conductors are substituted for copper, comply with the following:
 - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
 - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 3. Tinned Copper Conductors: Comply with ASTM B33.
 4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- H. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
- I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- J. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.
 - c. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - d. Service Wire Co: www.servicewire.com/#sle.
 - e. Southwire Company: www.southwire.com/#sle.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
1. Feeders and Branch Circuits:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.
 - 2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. Service Wire Co: www.servicewire.com/#sle.
 - 3. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Grounding: Full-size integral equipment grounding conductor.
- G. Armor: Steel, interlocked tape.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 4. Aluminum Conductors: Use compression connectors for all connections.
 - 5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
- C. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- D. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 - 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - c. NSI Industries LLC: www.nsiindustries.com/#sle.

- E. Push-in Wire Connectors: Rated 600 V, 221 degrees F.
 - 1. Manufacturers:
 - a. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - b. NSI Industries LLC: www.nsiindustries.com/#sle.
 - c. Wago Corporation: www.wago.us/#sle.
- F. Mechanical Connectors: Provide bolted type or set-screw type.
 - 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. IlSCO: www.ilsco.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- G. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 - 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. IlSCO: www.ilsco.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
 - 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. IlSCO: www.ilsco.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.06 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- C. Wire Pulling Lubricant:
 - 1. Listed and labeled as complying with UL 267.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Suitable for use at installation temperature.
- D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Circuiting Requirements:
 - 1. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 2. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 3. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Increase size of conductors as required to account for ampacity derating.
 - b. Size raceways, boxes, etc. to accommodate conductors.
 - 4. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install metal-clad cable (Type MC) in accordance with NECA 120.
- F. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
- I. Terminate cables using suitable fittings.
 - 1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- J. Install conductors with a minimum of 12 inches of slack at each outlet.
- K. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

- M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- N. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
- P. Insulate ends of spare conductors using vinyl insulating electrical tape.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- E. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 - 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
- F. Service-Supplied System Grounding:
 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Separately Derived System Grounding:
 1. Separately derived systems include, but are not limited to:
 - a. Generators, when neutral is switched in the transfer switch.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- H. Bonding and Equipment Grounding:
 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 4. Manufacturers:
 - a. nVent ERICO; TGBA16L08P: www.nvent.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- E. Ground Rod Electrodes:
 1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 260526

**SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260548 - Vibration and Seismic Controls for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Components for Vibration Isolation and/or Seismic Controls: Comply with Section 260548.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Comply with MFMA-4.
 2. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- G. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
- H. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Secure fasteners according to manufacturer's recommended torque settings.
- J. Remove temporary supports.

END OF SECTION 260529

SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. PVC-coated galvanized steel rigid metal conduit (RMC).
- E. Flexible metal conduit (FMC).
- F. Liquidtight flexible metal conduit (LFMC).
- G. Electrical metallic tubing (EMT).
- H. Rigid polyvinyl chloride (PVC) conduit.
- I. Conduit fittings.
- J. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 260529 - Hangers and Supports for Electrical Systems.
- E. Section 260533.16 - Boxes for Electrical Systems.
- F. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- G. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- H. Section 271000 - Structured Cabling: Additional requirements for communications systems conduits.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A) 2020.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.

- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- M. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- O. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.
- Q. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- R. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- T. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- U. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to PVC-coated galvanized steel rigid metal conduit where emerging from underground.
 - 5. Where steel conduit is installed in direct contact with earth, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
 - 6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
 - 1. Within Slab on Grade: Not permitted.
 - 2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.
 - 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or aluminum rigid metal conduit.
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 3 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

2.02 CONDUIT REQUIREMENTS

- A. Electrical Service Conduits: Also comply with Section 262100.
- B. Communications Systems Conduits: Also comply with Section 271000.
- C. Fittings for Grounding and Bonding: Also comply with Section 260526.
- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 2. Control Circuits: 1/2 inch (16 mm) trade size.
 3. Underground, Interior: 1 inch (27 mm) trade size.
 4. Underground, Exterior: 1 inch (27 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use aluminum.

3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Thomas & Betts Corporation: www.tnb.com/#sle.
 2. Robroy Industries: www.robroy.com/#sle.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- D. PVC-Coated Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.07 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.

3. International Metal Hose: www.metalhose.com/#sle.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.

2.09 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 2. Material: Use steel or malleable iron.
 3. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 1. Cantex Inc: www.cantexinc.com/#sle.
 2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
 3. JM Eagle: www.jmeagle.com/#sle.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- E. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

- F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- G. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. Conceal all conduits unless specifically indicated to be exposed.
 - 3. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 4. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 5. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
- I. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
 - 3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 5. Use of wire for support of conduits is not permitted.
- J. Connections and Terminations:
 - 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 - 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 - 3. Use suitable adapters where required to transition from one type of conduit to another.
 - 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Install conduits within middle one third of slab thickness.
 2. Secure conduits to prevent floating or movement during pouring of concrete.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- P. Provide grounding and bonding in accordance with Section 260526.

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

END OF SECTION 260533.13

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Floor boxes.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use suitable concrete type boxes where flush-mounted in concrete.
 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 6. Use shallow boxes where required by the type of wall construction.
 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 12. Wall Plates: Comply with Section 262726.
 13. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation:
www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
 - d. Thomas & Betts Corporation: www.tnb.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
- D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
 3. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes so that wall plates do not span different building finishes.
 - 4. Locate boxes so that wall plates do not cross masonry joints.
 - 5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
- E. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- F. Install boxes plumb and level.
- G. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- H. Install boxes as required to preserve insulation integrity.
- I. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- J. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- K. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- L. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- M. Close unused box openings.
- N. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- O. Provide grounding and bonding in accordance with Section 260526.

END OF SECTION 260533.16

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Underground warning tape.
- E. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 260573 - Power System Studies: Arc flash hazard warning labels.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- b. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
- c. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
- d. Centralized Emergency Lighting Inverters:
 - 1) Identify input and output voltage and phase.
 - 2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
- e. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
- 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
- 3. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
- 4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
- 5. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
- 6. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
- 7. Arc Flash Hazard Warning Labels: Comply with Section 260573.
- B. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within equipment enclosures when conductors and cables enter or leave the enclosure.
- C. Identification for Boxes:
 1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
- D. Identification for Devices:
 1. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
 2. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

2.04 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - 2. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
 - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Boxes: Outside face of cover.
 - 8. Conductors and Cables: Legible from the point of access.
 - 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

**SECTION 260573
POWER SYSTEM STUDIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators 2021.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Submit study reports prior to or concurrent with product submittals.
 - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Study reports, stamped or sealed and signed by study preparer.

1.05 POWER SYSTEM STUDIES

- A. Scope of Studies:
 - 1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 - 2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
- B. General Study Requirements:
 - 1. Comply with NFPA 70.
 - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
 - 1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
 - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Utility Company.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
 - e. Protective Devices:
 - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Study Reports:
- 1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.
 - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.

1.06 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
- B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

END OF SECTION 260573

**SECTION 260923
LIGHTING CONTROL DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Outdoor photo controls.
- C. Lighting contactors.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
- F. Section 265100 - Interior Lighting.
- G. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols 2020.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- F. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control Current Edition, Including All Revisions.
- I. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.
- J. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.
- K. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.

3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
- C. Shop Drawings:
 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
- D. Operation and Maintenance Data: Include detailed information on device programming and setup.
- E. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell.com/#sle.
 2. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 3. WattStopper: www.wattstopper.com/#sle.
- B. All Occupancy Sensors:
 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 2. Sensor Technology:
 - a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.

6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
- C. Wall Switch Occupancy Sensors:
 1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
- D. Wall Dimmer Occupancy Sensors:
 1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
 - b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
 2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- E. Ceiling Mounted Occupancy Sensors:
 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.

2.03 OUTDOOR PHOTO CONTROLS

- A. Button Type Outdoor Photo Controls
 1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
 2. Housing: Weather resistant polycarbonate.
 3. Photo Sensor: Cadmium sulfide.
 4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
 5. Voltage: As required to control the load indicated on the drawings.
 6. Failure Mode: Fails to the on position.
 7. Load Rating: As required to control the load indicated on the drawings.

2.04 LIGHTING CONTACTORS

- A. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- B. Short Circuit Current Rating:
- C. Enclosures:
 1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 3. Finish: Manufacturer's standard unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.
- G. Provide required supports in accordance with Section 260529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- J. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

3.02 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION 260923

SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 312316 - Excavation.
- F. Section 312323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
 - 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
 - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Contractor..
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.
- F. Scheduling:
 - 1. Arrange for inspections necessary to obtain Utility Company approval of installation.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1.05 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. IEEE C2 (National Electrical Safety Code).
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Utility Company: Evergy.
- D. Division of Responsibility: Per Utility Company requirements.
- E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required trenching and backfilling in accordance with Section 312316 and Section 312323.
- E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 033000.
- F. Provide required support and attachment components in accordance with Section 260529.
- G. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.
- H. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

END OF SECTION 262100

**SECTION 262416
PANELBOARDS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- E. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE: www.geindustrial.com/#sle.
- B. Eaton Corporation: www.eaton.com/#sle.
- C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- D. Siemens Industry, Inc: www.usa.siemens.com/#sle.
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 1. Altitude: Less than 6,600 feet.
 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- K. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Products:
 - 1. Square D: I-Line.
- C. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- D. Bussing:
 - 1. Phase and Neutral Bus Material: Aluminum.
 - 2. Ground Bus Material: Aluminum.
- E. Circuit Breakers:
 - 1. Provide bolt-on type.
- F. Enclosures:
 - 1. Provide surface-mounted enclosures unless otherwise indicated.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Products:
 - 1. Square D: NQOD.
- C. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- D. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum.
 - 3. Ground Bus Material: Aluminum.
- E. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- F. Enclosures:
 - 1. Provide surface-mounted enclosures.
 - 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - 7. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
 - 8. Provide the following features and accessories where indicated or where required to complete installation:

- a. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.06 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Provide filler plates to cover unused spaces in panelboards.
- N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 - 1. Emergency and night lighting circuits.
 - 2. Fire detection and alarm circuits.
 - 3. Communications equipment circuits.
 - 4. Intrusion detection and access control system circuits.
 - 5. Video surveillance system circuits.
- O. Identify panelboards in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [] amperes. Tests listed as optional are not required.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Correct deficiencies and replace damaged or defective panelboards or associated components.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

3.03 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

END OF SECTION 262416

**SECTION 262726
WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Fan speed controllers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.
- F. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 260583 - Wiring Connections: Cords and plugs for equipment.
- G. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
- M. UL 1917 - Solid-State Fan Speed Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Operation and Maintenance Data:
 - 1. Wall Dimmers: Include information on operation and setting of presets.
 - 2. GFCI Receptacles: Include information on status indicators.
- D. Project Record Documents: Record actual installed locations of wiring devices.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Wall Plates: One of each style, size, and finish.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices Installed in Finished Spaces: Gray with stainless steel wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- D. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.

- E. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.
- F. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.

2.03 WALL SWITCHES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, three way, or four way as indicated on the drawings.

2.04 FAN SPEED CONTROLLERS

- A. Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off switch, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
 - 1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.

2.05 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 - 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 - 3. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R.
 3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 4. Tamper Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
- E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
 - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
 2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A/C) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.06 WALL PLATES

- A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
 2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
 3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
 4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 2. Size: Standard.
 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- E. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
 2. Thomas & Betts Corporation: www.tnb.com/#sle.
- B. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.
- C. Flush Floor Service Fittings:
1. TYPE A: Single Service Flush Convenience Receptacles:
 - a. Cover: Round.
 - b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).

- c. Cover color shall be selected by architect from manufacturers standard options.
 - d. Hubbell System One S1PFB Box with single gang cover.
- 2. TYPE B: Dual Service Flush Combination Outlets:
 - a. Cover: Round, color selected by architect from manufacturers standard options.
 - b. Configuration:
 - 1) Power: One standard convenience duplex receptacle(s) with rectangular decorator style flap opening(s).
 - 2) Communications: BLANK.
- 3. Accessories:
 - a. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.
- 4. Products:
 - a. Hubbell Incorporated; S11PFB with S1SP cover: www.hubbell.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Wall Dimmers: 48 inches above finished floor.
 - c. Receptacles: 18 inches above finished floor or 6 inches above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.

- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- N. Identify wiring devices in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION 262726

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 260573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.
- C. Section 262816.16 - Enclosed Switches: Fusible switches.
- D. Section 262913 - Enclosed Controllers: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One set(s) of three for each type and size installed.
 - 3. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 APPLICATIONS

- A. General Purpose Branch Circuits: Class RK1, time-delay.

- B. Individual Motor Branch Circuits: Class RK1, time-delay.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 262813

**SECTION 262816.16
ENCLOSED SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- E. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Project Record Documents: Record actual locations of enclosed switches.

- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
 - 2. Minimum Ratings:
 - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Identify enclosed switches in accordance with Section 260553.

3.03 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION 262816.16

**SECTION 262913
ENCLOSED CONTROLLERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
 - 1. Manual motor starters.
- B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- E. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.
- H. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

PART 2 PRODUCTS

2.01 ENCLOSED CONTROLLERS

- A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.
- D. Service Conditions:
 - 1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
 - a. Altitude:

- 1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
 - 2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
- b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- E. Short Circuit Current Rating:
 1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- F. Conductor Terminations: Suitable for use with the conductors to be installed.
- G. Enclosures:
 1. Comply with NEMA ICS 6.
 2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 3. Finish: Manufacturer's standard unless otherwise indicated.
- H. Instrument Transformers:
 1. Comply with IEEE C57.13.
 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- I. Manual Motor Starters:
 1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
 2. Configuration: Non-reversing unless otherwise indicated.
 3. Fractional-Horsepower Manual Motor Starters:
 - a. Furnish with toggle operator.
 - b. Overload Relays: Bimetallic or melting alloy thermal type.
 - c. Provide means for locking operator in the OFF position.

2.02 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
 1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 3. Trip-free operation.
 4. Visible trip indication.
 5. Resettable.
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.
 6. Bimetallic Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.
 - b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
 - c. Trip test function.
 7. Melting Alloy Thermal Overload Relays:
 - a. Interchangeable current elements/heaters.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install controllers in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed controllers plumb and level.
- F. Provide grounding and bonding in accordance with Section 260526.
- G. Install all field-installed devices, components, and accessories.
- H. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- I. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

END OF SECTION 262913

**SECTION 263213
ENGINE GENERATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories:
 - 1. Engine and engine accessory equipment.
 - 2. Alternator (generator).
 - 3. Generator set control system.
 - 4. Generator set enclosure.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 235100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
 - 1. Includes installation of exhaust silencer specified in this section.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
- D. Section 260529 - Hangers and Supports for Electrical Systems.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 263600 - Transfer Switches.

1.03 REFERENCE STANDARDS

- A. ASTM D975 - Standard Specification for Diesel Fuel 2021.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA/EGSA 404 - Standard for Installing Generator Sets 2014.
- D. NEMA MG 1 - Motors and Generators 2021.
- E. NFPA 30 - Flammable and Combustible Liquids Code 2021, with Amendment (2020).
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 99 - Health Care Facilities Code 2021, with Amendment.
- I. NFPA 110 - Standard for Emergency and Standby Power Systems 2022.
- J. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids Current Edition, Including All Revisions.
- K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries Current Edition, Including All Revisions.
- L. UL 2200 - Stationary Engine Generator Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
 - a. Transfer Switches: See Section 263600.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.

3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Manufacturer's factory emissions certification.
- E. Manufacturer's detailed field testing procedures.
- F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- G. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- H. Maintenance contracts.
- I. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 1. NFPA 70 (National Electrical Code).
 2. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
 3. NFPA 30 (Flammable and Combustible Liquids Code).
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

- B. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Packaged Engine Generator Set - Basis of Design: Cummins Power Generation.
- B. Packaged Engine Generator Set - Other Acceptable Manufacturers:
 - 1. Caterpillar Inc: www.cat.com/#sle.
 - 2. Cummins Power Generation Inc: www.cumminspower.com/#sle.
 - 3. Generac Power Systems: www.generac.com/industrial/#sle. Generac Power Systems:
www.generac.com/industrial/#sle. Generac Power Systems:
www.generac.com/industrial/#sle.
 - 4. Kohler Co: www.kohlerpower.com/#sle.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 - 1. Application: Emergency/standby.
 - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
 - 3. Total System Power Rating: As indicated on drawings, standby.
- D. Packaged Engine Generator Set:
 - 1. Type: Gaseous (spark ignition).
 - 2. Basis of Design: Cummins C200N6.
 - 3. Power Rating: 200 kW, standby.
 - 4. Voltage: 208Y/120 V, 3 phase, 60 Hz.
 - 5. Main Line Circuit Breaker 600A:
 - a. Type: Thermal magnetic.
 - b. Trip Rating: Select according to generator set rating.
 - c. Features:
 - 1) Shunt trip.
- E. Generator Set General Requirements:
 - 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 - 2. Factory-assembled, with components mounted on suitable base.
 - 3. List and label engine generator assembly as complying with UL 2200.
 - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.

6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- G. Starting and Load Acceptance Requirements:
 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 60 seconds.
 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- H. Exhaust Emissions Requirements:
 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.
- I. Sound Level Requirements:
 1. Comply with Lee's Summit Noise Ordinance.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Gaseous (Spark Ignition):
 1. Fuel Source: Natural gas.
 2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
 - a. Carburetor.
 - b. Gas pressure regulators.
 - c. Fuel shutoff control valves.
 - d. Low gas pressure switches.
- C. Engine Starting System:
 1. System Type: Electric, with DC solenoid-activated starting motor(s).
 2. Battery(s):
 - a. Battery Type: Lead-acid.
 - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
 - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
 4. Battery Charger:

- a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.
- D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
- G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
 3. Exhaust Silencer: Provide critical grade or better exhaust silencer with sound attenuation not less than basis of design; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

2.04 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
 2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
 - 1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 - 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 - 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 - 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).

- 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
 - c. Provide contacts for local and remote common alarm.
 - d. Provide lamp test function that illuminates all indicator lamps.
- 5. Other Control Panel Features:
 - a. Event log.
- C. Remote Annunciator:
 - 1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
 - 2. Generator Set Status Indications:
 - a. Generator powering load (via position signal from transfer switch).
 - b. Communication functional.
 - 3. Generator Set Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. Provide audible alarm with silence function.
 - c. Provide lamp test function that illuminates all indicator lamps.
- D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.06 GENERATOR SET ENCLOSURE

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.

- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.
- H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.
- I. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 033000.
- F. Provide required support and attachment in accordance with Section 260529.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.
 - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 - 2. Do not exceed manufacturer's maximum back pressure requirements.
- I. Install exhaust silencer in accordance with Section 235100, where not factory installed.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

- F. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.
 - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
 - 3. Check for proper oil and coolant levels.
- G. Prepare and start system in accordance with manufacturer's instructions.
- H. Provide field emissions testing where necessary for certification.
- I. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Manufacturer's authorized representative.
 - 3. Location: At project site.

3.05 MAINTENANCE

- A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION 263213

**SECTION 263323
CENTRAL BATTERY EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Standard-transfer interruptible power supply (IPS) centralized emergency lighting inverters.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
 - 1. Indicate any inverter load restrictions.
- C. Shop Drawings: Indicate dimensions, input/output voltages, power ratings, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, and installed features and accessories.

PART 2 PRODUCTS

2.01 STANDARD-TRANSFER INTERRUPTIBLE POWER SUPPLY (IPS) CENTRALIZED EMERGENCY LIGHTING INVERTERS

- A. Manufacturers:
 - 1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
 - 2. Eaton Corporation: www.eaton.com/#sle.
 - 3. Emergi-Lite
 - 4. Source Limitations: Furnish inverter assemblies and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: Offline/standby type inverters with maximum 50 ms transfer time to battery power source upon loss of normal power source; suitable for operation of LED light sources.
- C. Standard-Transfer Interruptible Power Supply (IPS) Centralized Emergency Lighting Inverter:
 - 1. Basis of Design Product: Emergi-Lite.
 - 2. Nominal Input/Output Voltage: 120 VAC, 1 -phase, 2 -wire (plus ground) input/output.
 - 3. Nominal Power Rating: 1000W.
 - 4. Battery Type: Valve-regulated lead acid (VRLA)/sealed lead calcium.
 - 5. Battery Run Time at Full Output: 90 minutes.
 - 6. Output Circuit Breaker(s): As indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install inverter assemblies plumb and level.

3.02 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of emergency lighting inverter system to Owner, and correct deficiencies or make adjustments as directed.

END OF SECTION 263323

**SECTION 263600
TRANSFER SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.
 - 2. Manual transfer switches.
 - 3. Includes service entrance rated transfer switches.
 - 4. Includes bypass/isolation transfer switches.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 260573 - Power System Studies: Additional criteria for the selection of equipment specified in this section.
- F. Section 262100 - Low-Voltage Electrical Service Entrance.
- G. Section 263213 - Engine Generators: For interface with transfer switches.
 - 1. Includes related demonstration and training requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment 2020.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems 2022.
- G. UL 1008 - Transfer Switch Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - a. Engine Generators: See Section 263213.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- E. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- F. Maintenance contracts.
- G. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 1. NFPA 70 (National Electrical Code).
 2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 2 system.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transfer Switches - Basis of Design: ASCO Power Technologies.
- B. Transfer Switches - Other Acceptable Manufacturers:
 1. ABB/GE: www.electrification.us.abb.com/#sle.
 2. ASCO Power Technologies: www.ascopower.com/#sle.
 3. Eaton Corporation: www.eaton.com/#sle.
 4. Same as manufacturer of engine generator(s) used for this project.
- C. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Applications:
 - 1. Utilize open transition transfer unless otherwise indicated or required.
 - 2. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
 - a. Unless otherwise indicated or required, provide neutral switching:
 - 1) Where the alternate/emergency source is a separately derived system.
- D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- E. Automatic Transfer Switch:
 - 1. Transfer Switch Type: Service entrance rated bypass/isolation automatic transfer switch.
 - 2. Transition Configuration: Open-transition (no neutral position).
 - 3. Voltage: [_____].
 - 4. Ampere Rating: As indicated on the drawings.
 - 5. Neutral Configuration: Switched neutral.
 - 6. Load Served: As indicated on the drawings.
 - 7. Primary Source: As indicated on the drawings.
 - 8. Alternate Source: As indicated on the drawings.
- F. Manual Transfer Switch:
 - 1. Basis of Design: Same as automatic transfer switch.
 - 2. Voltage: As indicated on the drawings.
 - 3. Ampere Rating: As indicated on the drawings.
 - 4. Neutral Configuration: Solid neutral (unswitched), except as indicated.
- G. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- H. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- I. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- J. Switching Methods:
 - 1. Open Transition:
 - a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
 - 2. Neutral Switching: Either simultaneously switched neutral (break-before-make) or overlapping neutral (make-before-break) methods are acceptable.
 - 3. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- K. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
- L. Enclosures:

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
 2. Finish: Manufacturer's standard unless otherwise indicated.
- M. Short Circuit Current Rating:
1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
- N. Automatic Transfer Switches:
1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
 2. Control Functions:
 - a. Automatic mode.
 - b. Test Mode: Simulates failure of primary/normal source.
 - c. Voltage and Frequency Sensing:
 - 1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
 - 2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - 3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - d. Outputs:
 - 1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
 - 2) Auxiliary contacts; one set(s) for each switch position.
 - e. Adjustable Time Delays:
 - 1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
 - 2) Transfer to alternate/emergency source time delay.
 - 3) Retransfer to primary/normal source time delay.
 - 4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
 - f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.
 - g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
 3. Status Indications:
 - a. Connected to alternate/emergency source.
 - b. Connected to primary/normal source.
 - c. Alternate/emergency source available.
 4. Automatic Sequence of Operations:
 - a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
 - b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.

- c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
 - d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.
- O. Manual Transfer Switches:
 - 1. Description: Transfer switches with manually initiated transfer between sources; mechanically operated and mechanically held.
- P. Service Entrance Rated Transfer Switches:
- Q. Bypass/Isolation Transfer Switches:
 - 1. Description: Factory-assembled units consisting of interconnected transfer switch and bypass/isolation switch that permits manual bypass and isolation of the transfer switch with connection of the load to either source.
 - 2. Bypass/Isolation Switch Type: Provide overlapping (make-before-break) switches with no interruption of power to load. Load break (break-before-make) switches that interrupt power to load are not acceptable.
 - 3. Bypass/Isolation Operation:
 - a. Operable from exterior of enclosure.
 - b. Normal Mode: Provides for normal operation of transfer switch.
 - c. Test Mode: Provides for operational testing of bypassed transfer switch without affecting power to load.
 - d. Isolate Mode: Provides for complete isolation of transfer switch from all power sources, permitting removal from unit.
- R. Interface with Other Work:
 - 1. Interface with engine generators as specified in Section 263213.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Automatic Transfer Switches:
 - 1. Inspect and test in accordance with NETA ATS, except Section 4.
 - 2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Instructor: Manufacturer's authorized representative.
 - 3. Location: At project site.
- C. Coordinate with related generator demonstration and training as specified in Section 263213.

3.04 MAINTENANCE

- A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION 263600

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for distribution locations.
- B. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 262413 - Switchboards.

1.03 ABBREVIATIONS AND ACRONYMS

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- E. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- F. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Field-installed, Externally Mounted Surge Protective Devices:
 - 1. ABB/GE: www.geindustrial.com/#sle.
 - 2. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com/#sle.
 - 3. Schneider Electric; Square D Brand Surgelogic Products: www.surgelogic.com/#sle.
 - 4. Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.
- B. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
 - 1. Wye Systems: L-N, L-G, N-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
 - 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 1. Indoor clean, dry locations: Type 1.
- H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
 - 1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

2.03 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

- A. Surge Protective Device:
 - 1. Protection Circuits: Field-replaceable modular or non-modular.
 - 2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
 - 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 - 4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 - 5. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.

- b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.04 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Surge Protective Device:
 - 1. Protection Circuits: Field-replaceable modular or non-modular.
 - 2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
 - 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 - 4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 - 5. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- C. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- D. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Twist conductors together to reduce inductance.
- E. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

END OF SECTION 264300

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.16 - Boxes for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260923 - Lighting Control Devices.
- E. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.
- F. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.
- E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 1999 (Reaffirmed 2006).
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- I. UL 1598 - Luminaires Current Edition, Including All Revisions.
- J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 1. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
- F. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.
- C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.
- D. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.

- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 EXIT SIGNS

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 - 2. Directional Arrows: As indicated or as required for installed location.
- B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- H. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
- I. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 3. Install canopies tight to mounting surface.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
- M. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.02 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.03 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.04 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.05 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

**SECTION 265600
EXTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Poles and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1598 - Luminaires Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- E. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

2.03 POLES

- A. All Poles:
 - 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
 - 2. Structural Design Criteria:
 - a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 - 3. Material: Steel, unless otherwise indicated.
 - 4. Shape: Square straight, unless otherwise indicated.
 - 5. Finish: Match luminaire finish, unless otherwise indicated.
 - 6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Pole-Mounted Luminaires:
 - 1. Foundation-Mounted Poles:
 - a. Install foundations plumb.
 - b. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
 - c. Tighten anchor bolt nuts to manufacturer's recommended torque.
 - 2. Grounding:
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

3. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
- G. Install accessories furnished with each luminaire.
- H. Bond products and metal accessories to branch circuit equipment grounding conductor.
- I. Install lamps in each luminaire.

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.03 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.04 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600

SECTION 270010 - GENERAL COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section and to all following sections within Division 27.

1.2 SECTION INCLUDES

- A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.
- B. Division 27 of these Specifications, and Drawings numbered with prefix TN, generally describe these systems, but the scope of the Communications Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing, Electrical and Telecommunications Drawings and Specifications; and Addenda.
- C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets and cabling without showing all of the exact details as to elevations, offsets, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.
- D. Specifications define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.3 ABBREVIATIONS AND ACRONYMS

- A. ADA Americans with Disabilities Act
- B. AFF Above Finished Floor

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

C.	AHJ	Authority Having Jurisdiction
D.	ANSI	American National Standards Institute
E.	ASTM	American Society for Testing and Materials
F.	BICS	Building Industry Consulting Service International
G.	ETL	Electrical Testing Laboratories, Inc.
H.	FCC	Federal Communications Commission
I.	FM	Factory Mutual
J.	GE	Grounding Equalizer
K.	IEEE	Institute of Electrical and Electronic Engineers
L.	LED	Light Emitting Diode
M.	NEC	National Electrical Code
N.	NESC	National Electrical Safety Code
O.	NEMA	National Electrical Manufacturers Association
P.	NFPA	National Fire Protection Association
Q.	NRTL	Nationally Recognized Testing Laboratory
R.	OEM	Original Equipment Manufacturer
S.	OFCI	Owner Furnished Contractor Installed
T.	OSHA	Occupational Safety and Health Administration
U.	OSP	Outside Plant
V.	RCDD	Registered Communications Distribution Designer
W.	TBB	Telecommunications Bonding Backbone
X.	TGB	Telecommunications Grounding Bus-bar
Y.	TIA	Telecommunications Industries Association
Z.	TMGB	Telecommunications Main Grounding Bus-bar
AA.	UL	Underwriters Laboratories

BB. UON or UNO Unless Otherwise Noted

1.4 DEFINITIONS

A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:

1. AHJ - The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
2. Approved Equivalents or Equal - For specific products, materials, equipment, or systems for which this Division specifically identifies the Contractor shall use as the basis for their bid. Where the term approved equivalent or equal is listed the contractor may submit documentation for review by the Design Consultant for approval. The Design Consultant's acceptance or rejection is final.
3. As Directed - means as directed by the Contract Administrator, or his representative.
4. Communications Room - means the location of a floor-serving facility for housing telecommunication equipment, cable terminations, and cross-connect wiring, as well as those for audio video systems and potentially other low-voltage systems such as security and fire alarm (electronic safety and security). This room is recognized in ANSI/TIA-569 as the transition point between the telecommunications horizontal (station) pathway facilities and the backbone (riser) pathway facilities.
5. Concealed - means embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed within hung ceilings.
6. Conditionally Approved – the manufacturer has been found reputable by the design professional, but the design professional has not verified that the product offering by manufacturer meets to all specification requirements. Contractor shall adhere to submittal review process for final approval on products.
7. Contract Administrator: Where referenced in this Division, "Contract Administrator" is the primary liaison between the Owner and the Contractor. Specifically, for this project this is "the Owner's Representative".
8. Design Consultant - Where referenced in this Division, "Design Consultant" is the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Design Professional, in addition to involvement by, and obligations to, the "Architect".
9. Furnish - "To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."

10. Furnished by Owner (or Owner-Furnished) or Furnished by Others: "An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.
 11. Install - "To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
 12. NRTL - Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTL's that are acceptable to the AHJ, and standards that meet the specified criteria.
 13. Provide - "To furnish and install complete, and ready for the intended use." When 'furnish', 'install', 'perform', or 'provide' is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
 14. Submit - means submit to Contract Administrator for review.
 15. Substitution - means a product meeting all requirements and specifications and having been approved by the Design Consultant to replace another product specifically identified herein.
 16. Wet Location - means a pathway that does not protect cables from moisture levels that are beyond the intended operating range of "inside" premises cable.
 - a. For example: Slab-on-grade construction where pathways are installed underground or in concrete slabs that are in direct contact with soil (e.g., sand and gravel) is considered a "wet location."
 - b. Also refer to the:
 - 1) Telecommunications Distribution Methods Manual (TDMM) for definitions of Wet locations
 17. (*) – Where appearing in product part or model numbers; shall represent wild card character to be filled in by the contractor to meet required specifications.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Design Consultant as equivalent to the item or manufacturer specified".

- C. The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
- D. The following definitions apply to excavation operations:
 - 1. Additional Excavation: Where excavation has reached indicated sub-grade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 2. Sub-base: as used in this Section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.
 - 3. Sub-grade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.
 - 4. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Contract Administrator.

1.5 REFERENCE STANDARDS

- A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes. Bring all conflicts observed between codes, ordinances, rules, regulations and these documents to the Contract Administrator's and Design Consultant's attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.
- B. If the conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Contract Administrator and Design Consultant, without additional compensation. Contractor will be held responsible for any violation of the law.
- C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.

- D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes, including, but not limited to the following, except where these Drawings and Specifications exceed them.
- E. The references to the following codes, references and standards represent the most current and up-to-date revisions or printing as of the issue of this document including all sections, parts and their addenda. The Contractor is responsible for following the latest revision or printing (UON):
 - 1. ANSI/TIA-569 – “Commercial Building Standard for Telecommunications Pathways and Spaces”
 - 2. NFPA 70 – National Electrical Code (NEC)
 - 3. IEEE National Electrical Safety Code (NESC)
 - 4. Americans with Disabilities Act (ADA) of 1990, as amended

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with other Divisions for Communications work to be included but not listed in Division 27 or indicated on Communications Drawings.
- B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.
- C. Refer to Communications Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide all offsets, fittings, and accessories, required to clear equipment, beams and other structural members which may be required but not shown on the Drawings.
- D. Provide materials with trim that will fit properly the types of ceiling, wall, or floor finishes actually installed.
- E. Maintain a project manager, as specified by the Quality Assurance sections of these specifications, on the jobsite at all times to coordinate this Work with other trades so that various components of the Communications systems are installed at the proper time, fits the available space, allows proper service access to all equipment, and meets all required codes and standards.
- F. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
- G. Carry on the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.

- H. Work of this Division shall progress according to the "Construction Schedule" as described in Division 01 and as approved by the Contract Administrator. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of all schedule dates.
- I. Examine and compare the Contract Drawings and Specifications with the Drawings and specifications of other trades and report any discrepancies between them to the Contract Administrator and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- J. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections shall be made or which shall be changed or altered.
- K. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Contract Administrator.
- L. Measurements and Layouts: The Drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to the requirements of individual Sections. Additionally, prepare coordination drawings as required scope of installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one trade.
 - 1. Information shall be project specific and drawn accurately to a scale large enough to resolve conflicts. Do not base coordination drawings on standard dimensional data.
 - 2. Prepare floorplans, sections, elevations, and details as needed to adequately describe relationship of various systems and components.
 - 3. Clearly indicate functional and spatial relationships of components of all systems specified in the Contract Documents, including but not limited to: architectural, structural, civil, mechanical, electrical, fire protection, and specialty systems.
 - 4. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

5. Show location and size of access doors required for access to concealed equipment, fittings, controls, terminations, and cabling.
 6. Indicate required installation sequence to minimize conflicts between entities.
 7. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Contract Administrator indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
 8. The details of the coordination are the responsibility of the Contractor and, where indicated on the Drawings, minor adjustments in raceway routing, device placement, device type, or equipment arrangement are not to be considered changes to the Contract.
- B. Equipment Room Coordination Drawings: In accordance with the submittal procedures outlined within these Specifications, provide dimensioned layouts of communications equipment locations within communications (telecom and AV) rooms, electrical rooms/closets, mechanical rooms, generator rooms, and fire pump rooms with equipment drawn to scale and identified therein.
1. Clearly identify all required working clearances and access provisions required for installation and maintenance.
 2. Equipment layouts should be arranged accounting for considerations for required door openings and the clearances required by the equipment manufacturer.
 3. Indicate path to allow the future removal of each large piece of equipment (including but not limited to communications racks and cabinets) without removal of nonrelated equipment or architectural elements.
 4. Include work provided by others routed through the equipment rooms.
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
 - a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Contract Administrator.
 3. Where Henderson Engineer's digital data files are provided to the Contractor for use in preparing coordination digital data files, Henderson Engineers makes no representations as

to the accuracy or completeness of digital data files as they relate to the Drawings or Specifications.

4. Submit coordination drawings in accordance with the submittal procedures outlined within these Specifications.

- D. Refer to Coordination requirements in specific sections for additional information.

1.8 SUBMITTALS

- A. Refer to Division 01 and General Conditions for submittal requirements in addition to requirements specified herein.
- B. Refer to Division 01 for acceptance of electronic submittals. If not specified by Division 01, provide electronic submittals. If Division 01 requires paper submittals, provide the quantity of submittals required, but no fewer than seven (7) sets.
- C. For electronic submittals, Contractor shall submit the documents in accordance with this Section and the procedures specified in Division 01. Contractor shall notify the Contract Administrator and Design Consultant that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, username and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Contract Administrator's and Design Consultant's designated representatives. Contractor shall allow for the Design Consultant Review Time as specified. Contractor shall submit only the documents required to purchase the materials and/or equipment in the submittal.
- D. Design Consultant Review Time: Transmit submittals as early as required to support the project schedule. Allow two weeks for Design Consultant review time plus to/from mailing time via the Contract Administrator, plus a duplication of this time for resubmittal if required. Transmit submittals as soon as possible after Notice to Proceed and before Mechanical construction starts.
- E. Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, the license agreement for transfer of information obtained from the Engineer must be used.
- F. Assemble and submit for review manufacturer product literature for material and equipment to be furnished and/or installed under this Division. Literature shall include shop drawings, manufacturer product data, performance sheets, samples, and other submittals required by this Division as noted in each individual Section. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.
- G. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.
- H. Unless noted otherwise within each individual section, submittals shall be provided for approval in four distinct phases:

1. Pre-bid
 - a. Required no less than two weeks prior to the due date for the submission of bids, such as:
 - 1) Product substitutions, approved alternate or equivalent requests to be reviewed for approval (Prior to Bid)
 - 2) Alternate personnel credentials to be reviewed for approval
 - 3) And as required by individual sections in this Division
2. Bid
 - a. Required at the time of the submission of bids, such as:
 - 1) Bid Response Forms
 - 2) Unit Pricing (if required by sections in this Division)
 - 3) Personnel Qualifications
 - 4) Contractor Qualifications (Previous project references)
 - 5) Voluntary Bid Alternates
 - 6) And as required by individual sections in this Division
3. Pre-construction
 - a. Required after the award of the project to the winning bidder and prior to starting construction.
 - b. Submit the following items no longer than four weeks after receiving the notice to proceed:
 - 1) Division of Labor amongst sub-contractors. Include:
 - a) Company Name
 - b) Address
 - c) Name of project manager for this project, including:
 - i) E-mail
 - ii) Telephone number
 - 2) Construction schedule showing important milestone dates and activities. Schedule shall be coordinated with overall project construction schedule.

- 3) Updated Personnel and Contractor Qualifications where different from those submitted during the Bid phase.
 - 4) A typed list, indexed by Specification section, of products specifically identified by part number (no wild card characters) within each specification section in this Division. Products are to be listed in the same order as in the specification. List is to include length of manufacturer warranty for each product.
 - 5) Manufacturers' cut-sheets:
 - a) Cut-sheets are to be in the same order as in the specification sections.
 - b) At a minimum all cut-sheets shall contain the following:
 - i) Cross-reference to the specification section and/or drawings for which the product is to be reviewed for compliance and acceptance
 - ii) Every product cut-sheet submitted for review shall contain the manufacturers' name and logo somewhere on the page
 - iii) All parts, pieces, and equipment submitted for review shall be clearly identified by stamp, markup, or highlight in such a manner that the product(s) being submitted are clearly identifiable and distinguished from all other materials, parts, or equipment that may be on the submittal.
 - iv) For cut-sheets with accessories, additional parts, or derivations of the product being submitted, all shall be clearly identified for the reviewer and acceptance.
 - v) Sufficient detail for reviewer to identify all required information, such as size, weight, color, NRTL listings, approval or certification information, and other necessary identifying information to confirm product meets specifications.
 - 6) Samples – refer to individual sections for specific sample requirements.
 - a) Samples requested shall be physical examples that represent materials, equipment or workmanship and establish standards by which the work will be judged. Contractor or Manufacturer shall cover all associated fabrication and shipping costs.
- c. Submit the following items sufficiently prior to installation of each respective portion of work:
- 1) Shop Drawings

- a) Shall be furnished per the requirements of each Division 27 specification Section.

4. Project Completion

- a. Required after the substantial completion but prior to final approval for completion, such as:
 - 1) Record Drawings
 - 2) Operation and Maintenance Data
 - 3) Project test reports
 - 4) Cable Databases (as applicable)
 - 5) Warranty Certificate(s)
 - 6) Lead Installer / Project manager letter with signature stating the project has been installed in accordance with referenced industry standards and contract documents.
 - 7) And as required by individual sections in this Division
- I. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Illegible submittals will be rejected and returned without review.
- J. Refer to individual Sections for additional submittal requirements.
- K. No part of the work shall be started in the shop or in the field until the shop drawings and /or samples for that portion of the work have been submitted and accepted.
- L. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- M. Submittals shall contain the following information:
 - 1. The project name.
 - 2. The applicable specification section and paragraph.
 - 3. Equipment identification acronym as used on the drawings.
 - 4. The submittal date.

5. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
 6. Submittals not so identified will be returned to the Contractor without action.
- N. The checking and subsequent acceptance by the Design Consultant and/or Contract Administrator of submittals shall not relieve responsibility from the Contractor for (1) deviations from Drawings and Specifications; (2) errors in dimensions, details, sizes of equipment, or quantities; (3) omissions of components or fittings; and (4) not coordinating items with actual building conditions and adjacent work. Contractor shall request and secure written acceptance from the Design Consultant and Contract Administrator prior to implementing any deviation.

1.9 SUBSTITUTIONS

- A. Refer to Division 1 and General Conditions for substitutions in addition to requirements specified herein.
- B. Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.
- C. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.
- D. Request for Substitution:
 1. Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.
 2. The burden of proof of the merit of the proposed substitution is upon the proposer.
 3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Contract Administrator, and Owner the following:
 - a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
 - b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
 - c. Proposed substitution has received necessary approvals of the Authorities Having Jurisdiction.
 - d. Same warranty will be furnished for proposed substitution as for specified Work.

- e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
- f. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

E. Substitution Consideration:

- 1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.
- 2. No substitutions will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.
- 3. If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other manner. Verbal approval will not be given.
- 4. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.10 ELECTRONIC DRAWING FILES

- A. In preparation of shop drawings or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of \$200 for a drawing set up to 12 sheets and \$15 per sheet for each additional sheet.
- B. Contractor shall request and complete the Electronic File Release Agreement form from the Engineer. Send the form along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form.
- C. Contact the Contract Administrator for written authorization.
- D. The following must be received before electronic drawing files will be sent:
 - 1. Contract Administrator's written authorization
 - 2. Engineer's release agreement form
 - 3. Payment

1.11 QUALITY ASSURANCE

- A. Execute all work under this Division in a thorough and professional manner by competent and experienced workmen duly trained to perform the work specified.

- B. Install all work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.
- C. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer whenever practicable.
- D. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

1.12 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Division 1 and General Conditions for Operation and Maintenance Manuals in addition to requirements specified herein.
- B. Submit manuals prior to requesting the final punch list and before all requests for Substantial Completion.
- C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.
- D. Prior to Substantial Completion of the project, furnish to the Contract Administrator, for Engineer's review, and for the Owner's use, four (4) copies of Operation and Maintenance Manuals in labeled, hard-back three-ring binders, with cover, binding label, tabbed dividers and plastic insert folders for Record Drawings. Include local contacts, complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.
- E. Each manual shall contain equipment data, approved submittals, shop drawings, diagrams, capacities, spare part numbers, manufacturer service and maintenance data, warranties and guarantees.
- F. Refer to Division 1 for acceptance of electronic manuals for this project. For electronic manuals, Contractor shall submit the documents in accordance with this Section and the procedures specified in Division 1. Contractor shall notify the Contract Administrator and Engineer that the manuals have been posted. If electronic manual procedures are not defined in Division 1, Contractor shall include the website, username and password information needed to access the manuals. For manuals sent by e-mail, Contractor shall copy the Contract Administrator's and Engineer's designated representatives.

1.13 SPARE PARTS

- A. Provide to the Owner the spare parts specified in the individual sections of this Division.

1.14 RECORD DRAWINGS

- A. Refer to Division 01 and General Conditions for Record Drawings in addition to requirements specified herein.
- B. A set of work prints of the Contract Documents shall be kept on the jobsite during construction for the purpose of noting changes. During the course of construction, the Contractor shall indicate on these Documents changes made from the original Contract Documents. Particular attention shall be paid to those items which need to be located for servicing. Underground utilities shall be located by dimension from column lines.
- C. At the completion of the project, the Contractor shall obtain, at their expense, reproducible copies of the final drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done by a skilled drafter. Each sheet shall be marked "Record Drawing", along with the date. These drawings shall be delivered to the Contract Administrator.

1.15 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 01 and General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.
- B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.
- C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Contract Administrator.
- D. Be responsible for the safe storage of tools, material and equipment.

1.16 WARRANTIES

- A. Refer to Division 01 and General Conditions for Warranties in addition to requirements specified herein.

- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- C. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these Construction Documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.
- D. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.
- E. Perform the remedial work promptly, upon written notice from the Contract Administrator or Owner.
- F. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one-year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.17 TEMPORARY FACILITIES

- A. Refer to Division 1 and General Conditions for Temporary Facilities requirements.
- B. Temporary Utilities: The types of services required include, but are not limited to, electricity, telephone, and internet. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.

1.18 FIELD CONDITIONS

- A. Conditions Affecting Work In Existing Buildings: The following project conditions apply:
 - 1. The Drawings describe the general nature of remodeling to the existing building; however, visit the Site prior to submitting bid to determine the nature and extent of work involved.
 - 2. Schedule Work in the existing building with the Owner.
 - 3. Perform certain demolition work prior to the remodeling. Perform the demolition that involves Communications systems, equipment, raceways, equipment supports or foundations and materials.
 - 4. Remove articles that are not required for the new Work. Unless otherwise indicated, remove each item removed during this demolition from the premises and dispose in accordance with applicable federal, state and local regulations.

5. Relocate and reconnect Communications facilities that shall be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where communications equipment or materials are removed, cap unused raceways below the floor line or behind the wall line to facilitate restoration of finish.
 6. Obtain permission from the Contract Administrator for channeling of floors or walls not specifically noted on the Drawings.
 7. Protect adjacent materials indicated to remain. For Work specific to this Division, install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 8. Locate, identify, and protect Communications services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services shall be interrupted, provide temporary services for affected areas.
- B. Conditions Affecting Excavations: The following project conditions apply:
1. Maintain and protect existing building services that transit the area affected by selective demolition.
 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
- C. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
- D. Use of explosives is not permitted.
- E. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits specified by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 EXISTING CONDITIONS

- A. Existing conditions indicated on the Drawings are taken from the best information available from the Owner, existing record drawings, and from limited, in-situ, visual site observations; and, they are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new Work.
- B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

3.3 EXISTING UTILITIES

- A. Existing utility services not specifically indicated to be removed or altered shall remain as they presently exist.
- B. Where existing services interfere with demolition or construction, alter or reroute such existing equipment to facilitate demolition or construction after obtaining written permission from the Contract Administrator. Notify in writing giving two weeks advance notice or planned alteration prior to altering any existing condition is required.
- C. Schedule and coordinate with the utility company, Owner and with the Contract Administrator all connections to, relocation of, or discontinuation of normal services from any existing service provider line. Include all premium time required for all such work in the Bid.
- D. Preserve continuity of service of existing facilities (related to damage or alteration due to new construction). Unauthorized alteration to existing equipment shall be corrected without additional cost to the Owner.
- E. Repair all existing utilities damaged due to construction operations to the satisfaction of the Owner or Utility Company without additional cost.
- F. Do not leave utilities disconnected at the end of a workday or over a weekend unless authorized by representatives of the Owner or Contract Administrator.
- G. Make repairs and restoration of utilities before workmen leave the project at the end of the workday in which the interruption takes place.
- H. Include in Bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.

3.4 EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.

- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical, electrical, communications, and Electronic Safety and Security installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.5 WORK IN EXISTING FACILITIES

- A. The Drawings describe the general nature of remodeling to the existing facilities; however, visit the Site prior to submitting a Bid, to determine the nature and extent of Work involved.
- B. Schedule Work in the existing facility with the Owner.
- C. Certain demolition work shall be performed prior to the remodeling. Perform the demolition that involves communications systems, conduit, wiring, equipment, equipment supports or foundations and materials.
- D. Remove all of these articles that are not required for the new Work. Unless otherwise indicated, each item removed during this demolition shall be removed from the premises and disposed of in accordance with all state and local regulations.
- E. Interruption of Existing Communications Service: Do not interrupt communication service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary communication service according to requirements indicated:
 - 1. Notify Contract Administrator and the Owner no fewer than 7 days in advance of proposed interruption of communication service.
 - 2. Do not proceed with interruption of communication service without Contract Administrator and the Owner's written permission.
 - 3. Owner reserves the right to require Contractor to cease work in any area Owner requires access to on an emergency basis.
- F. Reconnect communication circuits serving equipment required to remain in service to other cable termination fields, patch panels or splices as indicated on the Drawings or as appropriate. Provide additional cable and termination hardware where there is insufficient available capacity in remaining existing equipment for reconnection.
- G. Relocate and reconnect all communications facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where communications devices or equipment are removed, cap all unused raceways behind the floor line or wall line to facilitate restoration of finish, and remove all existing wiring from abandoned raceways.
- H. Finish materials are specified in other divisions.

- I. Where removal of existing wiring interrupts continuity of communication circuits that are to remain in use, provide necessary wiring, raceways, junction boxes, etc., to ensure continued communication continuity.
- J. Channel walls and floors as required to produce the desired result; however, obtain permission from the Contract Administrator for all channeling not specifically noted on the Drawings.

3.6 PERMITS AND FEES

- A. Secure and Pay all required fees and obtain all required permits related to the Communications Infrastructure installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.

3.7 SELECTIVE DEMOLITION

- A. Refer to Division 01, Division 02, and General Conditions for Selective Demolition requirements.
- B. General: Demolish, remove, demount, and disconnect abandoned communications materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- C. Materials and Equipment to Be Salvaged:
 - 1. Communications Infrastructure equipment to be removed that is in good working order shall be carefully removed and offered to the Owner. Items rejected by the Owner shall be removed from the project site and legally and properly disposed of.
 - 2. Remove, demount, and disconnect existing communications materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- D. Remove existing conduit and wire back to the Communications Equipment room, unless a specific extent of removal is indicated on the Drawings.
- E. Communications Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete raceways, fittings, supports and specialties, equipment, wiring, controls, fixtures, and insulation:
 - a. Raceways and outlets embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Cut embedded raceways to below finished surfaces, seal, and refinish surfaces as specified or as indicated on the Architectural Finish Drawings. Remove materials above accessible ceilings. Cap raceways allowed to remain.

- b. Perform cutting and patching required for demolition in accordance with Division 01, General Conditions and "Cutting and Patching" portion of this Section in Division 27.

3.8 ACCESS TO EQUIPMENT

- A. Locate all pull boxes, junction boxes and controls so as to provide easy access for operation, service inspection and maintenance. Provide an access door where equipment or devices are located above inaccessible ceilings. Refer to Division 26 Section "Common Work Results for Electrical".
- B. Maintain all code required clearances and clearances required by manufacturers.

3.9 PENETRATIONS

- A. Unless otherwise noted as being provided under other divisions, provide sleeves, box frames, or both, for openings in floors, walls, partitions and ceilings for all electrical work that passes through construction. Refer to Division 27 Section "Common Work Results for Communications".
- B. Provide sleeves, box frames, or both, for all conduit, cable, and cable trays that pass-through masonry, concrete or block walls.
- C. The cutting of new and/or existing construction will not be permitted except by written approval of the Contract Administrator.

3.10 EXCAVATION AND BACKFILLING

- A. Refer to Division 01, Division 02 and General Conditions for Excavation and Backfilling in addition to the requirements specified herein.
- B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this division. Excavation shall be in conformance with applicable Divisions and sections of the Specifications.
- C. Restore roads, alleys, streets and sidewalks damaged during this work to the satisfaction of Authorities Having Jurisdiction.
- D. Do not excavate trenches close to walks or columns without prior consultation with the Contract Administrator.
- E. Erect barricades around excavations, for safety, and place an adequate number of amber lights on or near the work and keep those burning from dusk to dawn. Be responsible for all damage that any parties may sustain in consequence of neglecting the necessary precautions in prosecuting the work.

- F. Slope sides of excavations to comply with local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.
- G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
 - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- H. Install sediment and erosion control measures in accordance with local codes and ordinances.
- I. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.
- J. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
 - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- K. Excavation for Underground Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus, a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 - 1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of one inch in diameter and larger with emulsified asphalt tree paint.
 - 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- L. Trenching: Excavate trenches for electrical installations as follows:
 - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of six to nine inches clearance on both sides of raceway and cables.

2. Excavate trenches to depth indicated or required for raceway and cables to establish slope, away from buildings and indicated elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
 3. Limit the length of open trench to that in which raceway and cables can be installed, tested, and the trench backfilled within the same day.
 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceway and cables. Provide a minimum of six inches of stone or gravel cushion between rock bearing surface and raceway and cables.
 5. Excavate trenches for raceway, cables, and equipment with bottoms of trench to accurate elevations for support of raceway and cables on undisturbed soil.
- M. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- N. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
1. Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
 2. Under building slabs, use drainage fill materials.
 3. Under raceway and cables, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation.
 4. For raceway and cables less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of raceway and cables, provide a 4-inch-thick concrete encasement (sides and top) prior to backfilling and placement of roadway subbase.
 5. Other areas use excavated or borrowed materials.
- O. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids.
 4. Removal of trash and debris.
- P. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

1. For vertical and diagonal raceway installations, thoroughly support raceways from permanent structures or undisturbed earth at no less than 10-foot intervals, while placing backfill materials, so that raceways are not deflected, crushed, broken, or otherwise damaged by the backfill placement.
- Q. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- R. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- S. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas Under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 90 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - c. Other Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.
- T. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.11 CUTTING AND PATCHING

- A. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this Division.
- B. Obtain permission from the Architect prior to cutting. Do not cut or disturb structural members without prior approval from the Architect and Structural Engineer.
- C. For post-tension slabs, x-ray slab and closely coordinate all core drill locations with Architect and Structural Engineer prior to performing any work. Obtain approval from Architect and Structural Engineer for all core drills and penetrations at least four days prior to performing work.
- D. Penetrations shall be made as small as possible while maintaining required clearances between the building element penetrated and the system component.
- E. Patch around openings to match adjacent construction, including fire ratings, if applicable.
- F. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

3.12 PAINTING

- A. Refer to Division 09 Section "Painting" for painting requirements.
- B. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under individual sections and Division 09 of the Specifications; colors shall be as selected by the Contract Administrator.
- C. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.
- D. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.
- E. Where factory finishes are provided and no additional field painting is specified, touch up or refinish, as required by, and to the acceptance of, the Contract Administrator, marred or damaged surfaces so as to leave a smooth, uniform finish. If, in the opinion of the Contract Administrator, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.

3.13 CLEANING

- A. Remove dirt and refuse, resulting from the performance of the Work, from the premises as required to prevent accumulation. Cooperate in maintaining reasonably clean premises at all times.

- B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises vacuum clean. Clean all material and equipment installed under this Division.
- C. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.
- D. Touch up and restore damaged finishes to their original condition.
- E. All communications equipment shall be thoroughly vacuumed and wiped clean prior to startup and at the completion of the project. Equipment shall be opened for observation as required.

3.14 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align and test all equipment furnished and/or installed under this Division.
- B. Check and test protective devices for specified and required application and adjust as required.
- C. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.
- D. Notify the Contract Administrator immediately of all operational failures caused by defective material, labor or both.
- E. Refer to individual Sections for additional and specific requirements.

3.15 START-UP OF SYSTEMS

- A. Prior to start-up of each system, check all components and devices to confirm compliance with manufacturers' recommended installation procedures.
- B. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.
- C. Refer to individual Sections for additional and specific requirements.

3.16 SUBSTANTIAL COMPLETION REVIEW

- A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:
 - 1. Submit results of systems tests and adjustments per each individual section.
 - 2. Submit complete Operation and Maintenance Data.
 - 3. Submit complete Record Drawings.

4. Perform all required training of Owner's personnel.
 5. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
 6. Perform start-up tests of all systems.
 7. Remove all temporary facilities from the site.
 8. Comply with all requirements for Substantial Completion in the Division 1 and General Conditions.
- B. Request in writing a review for Substantial Completion and scheduling of final acceptance. Provide a minimum of five (5) business days' notice prior to the review for project sites within a 4-hour drive from the office where the design was created; provide a minimum of eight (8) business days' notice for sites beyond a 4-hour drive.
- C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.
- D. Upon receipt of a request for review, the Contract Administrator will either proceed with the review or advise the Contractor of unfilled requirements.
- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, then provide reimbursement to the Contract Administrator and Design Consultant for time and expenses incurred for the visit.
- F. Upon completion of the review, the Contract Administrator and Design Consultant will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.
- G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.
- H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

3.17 EARLY OCCUPANCY

- A. Failure to meet the Substantial Completion date can result in the Owner needing to take early occupancy. Complete the systems which are necessary to allow partial early occupancy of the building by original Substantial Completion date.
1. Refer to individual sections for additional requirements.
- B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

END OF SECTION

SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

- A. This Section includes general construction materials and methods, communications equipment coordination, and common communications installation requirements for Division 27 systems as follows:
 - 1. Grounding and Bonding for Communications
 - 2. Pathways for communications systems.
 - a. Cable Supports
 - b. Conduit
 - c. Surface Raceways
 - d. Outlet Boxes
 - e. Pull Boxes
 - 3. Firestopping Systems
 - 4. Access Panels
 - 5. Identification

1.2 RELATED REQUIREMENTS

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in the following Sections: 27 Section "General Communications Requirements"
- B. Division 07 Section "Penetration Firestopping" for fire stopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
- C. Division 26 for reference regarding materials and methods for additional requirements.
- D. Division 27 "General Communications Requirements"

1.3 DEFINITIONS

- A. ASTM - American Society for Testing and Materials
- B. AV – Audio Video
- C. Cable Tray System – A unit or assembly of units or sections and associated fittings forming a structural system used to securely fasten or support cables and raceways.
- D. Common Work – all Work specified in this section.
- E. Conduit Body – A separate portion of a conduit or tubing system that provides access through a removeable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system. Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies.
- F. Conveniently Accessible – Capable of being reached from the floor or via the use of an 8 foot step ladder without crawling or climbing over or under obstacles such as piping, duct work, motors, transformers, pumps, etc.
- G. Firestopping System – Firestopping products that have been specifically tested and rated by a Nationally Recognized Testing Laboratory (NRTL), such as UL, to provide the required flame (F), fire and temperature (T), air and smoke (L), and water (W) containment for a given partition/penetration.
- H. Floor Box Assembly (Floor Box) – An on-grade solution or above grade (with a native fire classification or in combination with an approved Firestopping System) solution for in-floor terminations. The Assembly consists of pour pan (as applicable), Firestopping System (as applicable), floor box (compartment), plate mounting brackets, line voltage divider plates, termination plates, termination connectors, electrical receptacle(s), gang plates (termination cover plates), and access door / cover / lid.
- I. FM – Factory Mutual
- J. Ground or Grounding – A conducting connection, whether intentional or accidental, between an electrical circuit (e.g. telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.
- K. IMC – Intermediate Metal Conduit
- L. NEMA – National Electrical Manufacturers Association
- M. Plenum – A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
- N. Plenum-rated – A product that is listed by a NRTL as being suitable for installation into a plenum space.
- O. Point of Entrance (Building Entrance) – The point within a building where the Outside Plant (OSP) communications cabling emerges from an external wall, a concrete floor slab, or

IMC/RMC. If Communications Point of Entrance isn't identified on the drawings, assume the Main Communications (MDF) also acts as the Point of Entrance.

- P. Poke Through Assembly (Poke-Thru) – An above grade solution with a native fire classification for in-floor terminations. The Assembly consists of pre-pour sleeve (as applicable), Firestopping System, fire resistant conduit stub, poke thru (compartment), plate mounting brackets, line voltage divider plates, termination plates, termination connectors, electrical receptacle(s), gang plates (termination cover plates, as applicable), and access door / cover / lid.
- Q. Quality Control Specialist – as it pertains to Work within this section, Quality Control Specialist is either the Project RCDD, as defined in Division 27 Section “Structured Cabling System”, for Common Work for Telecommunications or the Project AVIXA CTS-I, as defined in Division 27 Section “Audio Video Systems”, for Common Work for AV.
- R. RMC – Rigid Metal Conduit
- S. Surface Metal Raceway – A metallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.
- T. Surface Nonmetallic Raceway – A nonmetallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.
- U. UL – Underwriters Laboratory

1.4 REFERENCE STANDARDS

- A. Follow all applicable codes, references, guidelines, and standards listed in Division 27 Section “General Communications Requirements”.
- B. Follow the additional codes, references, standards and guidelines:
 - 1. ASTM E 814 and ANSI/UL1479 –“Fire Tests Through Penetration Firestops”
 - 2. ASTM E 84 and ANSI/UL 723 “Surface Burning Characteristics of Building Materials”
 - 3. ASTM E 119 and ANSI/UL 263 “Fire Tests of Building Construction Materials”

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Adjust location of conduits, terminal blocks, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication:

1. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
 3. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed.

1.6 SUBMITTALS

- A. Follow the requirements for submittals in Division 27 Section "General Communications Requirements".
- B. Bid Submittal
1. Contractor Qualifications for Firestopping Systems: Provide copies of training/certification as required in the Quality Assurance portion of this specification section.
- C. Pre-construction Submittal
1. Manufacturers' cut sheets or catalog cut sheets of each of the pathways not specifically identified by its exact part number:
 - a. In addition to Division 27 Section "General Communications Requirements", include the following:
 - 1) Size – including physical and loading dimensions
 - 2) Maximum span length
 - 3) Weight supported
 - 4) Type
 - 5) Fittings to be used
 - 6) Method of attachment to structure
 - 7) Firestop system assembly information for each system to be installed:

- a) Documentation from UL catalog for each system proposed. This documentation shall include the following information:
 - i) Firestop manufacturer
 - ii) UL system number
 - iii) F, T, and L Ratings
 - iv) The complete description of the firestop system; To include what specific construction the system is intended to pass through such as a wall or floor assembly, the penetrating items allowed to pass through the opening in the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings.
- 8) As well as any additional information required by individual sections of this Division

2. Shop Drawings

- a. Submit for review scaled layout drawings showing the size/routing of all pathways and the size/information/locations of all boxes, pullboxes, firestopping systems, and access panels.
 - 1) Each pathway shall be identified by type and size on the drawings.
 - a) Example #1: 4" EMT
 - b) Example #2: 4" x 12" Cable Tray
 - 2) Each grounding conductor shall be identified by size (and insulation):
 - a) Example: #3/0 insulated ground
 - 3) Each firestop system shall be identified by Manufacturer and Product, as well as UL system number for that particular location.
 - a) Example #1 – Firestopping Sleeve:
EZ-Path Series 22, UL System W-L-3255
 - b) Example #2 – Backbox in Fire-Rated Wall:
Specseal Power Shield, UL System QCSN/CLIV.R14288
 - 4) Each pullbox and access panel shall be identified by size and height above finished floor.
 - a) Pullbox Example: Pullbox 8" x 24" x 40" approximately 12' AFF.

- b. Unless otherwise required by these specifications, it is permissible to show pathways systems (conduit, cable tray, auxiliary supports, etc.) on the same shop drawing along with the cabling and system work to be installed through those pathways.
 - 1) Division 271000 "Structured Cabling System" and Division 274100 "Audio Video Systems" and their individual pathways shall be separate shop drawings; shared pathways such as cable tray shall be shown on both shop drawings.

D. Project Completion Submittal

1. Record Drawings:

- a. The Quality Control Specialist shall review the installation and Record Drawings for the Common Work Results required for their scope of work and shall stamp the final Record Drawings with their RCDD or CTS-I stamp before submission. By stamping the Record Drawings, the Quality Control Specialist indicates that the Common Work Results have been installed per the Contract Documents and all associated codes, standards, and guidelines, and all changes to the drawings have been incorporated into the Record Drawings.

1.7 QUALITY ASSURANCE

A. Submittals and Shop Drawings for all Common Work Results specified in this section shall, if not created by, be reviewed by the Quality Control Specialist.

- 1. The Quality Control Specialist shall stamp all relevant submittals for their associated Division 27 sections, which indicates that at a minimum the proposed work has been reviewed by them and found to be in compliance in regards to:
 - a. All applicable codes and industry standards and guidelines referenced in Division 27.
 - b. Being fully-coordinated with all other trades and to be installed per the Construction Documents.
 - c. And installed per manufacturer's direction.

B. The Quality Control Specialist shall also make weekly inspections during construction to ensure all work installed per this section is correct.

- 1. Any deficiencies encountered prior to and during installation shall be corrected by the installing contractor under the direction of the Quality Control Specialist and/or the Design Consultant.

C. Firestopping Systems

1. Firestopping material and systems shall be tested and listed by UL. All firestopping products shall bear this classification marking.
2. Installation technicians shall be by qualified and trained personnel. Acceptable installer qualifications are as follows:
 - a. FM Research, approved in accordance with FM AS 4991.
 - b. Individuals who are trained and certified by the firestopping manufacturer. For Specified Technologies, all installers shall have current FIT Level 1 certification.

1.8 NOISE CRITICAL SPACES

- A. Many areas of the building, referred to as "noise-critical spaces", require special attention (special acoustical provisions and restrictions). The list below designates the noise-critical spaces that will require application of sound attenuating measures and acoustical sealants or sleeves.
 1. Offices
 2. Conference Rooms
 3. Bunk Rooms

PART 2 - PARTS AND MATERIALS

2.1 GROUNDING AND BONDING FOR COMMUNICATIONS

- A. Refer to drawings and Division 27 Sections "Telecommunications Equipment Room Fittings" and "Audio Video Systems" for exact grounding and bonding requirements.

2.2 PATHWAYS FOR COMMUNICATIONS SYSTEMS

- A. General
 1. All non-continuous cable supports shall be designed to prevent degradation of cable performance and pinch points that could damage cable
 2. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
 3. Telecommunications pathways shall be routed back to serving Communications Room. Refer to Drawings for additional information.
- B. Cable Supports

1. The following manufacturers are Conditionally Approved.
 - a. Cooper/B-Line
 - b. Hilti
 - c. Monosystems
 - d. nVent Caddy
 - e. Panduit
 - f. Snake Tray
 - g. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
2. Metal Hook Supports ("J-hooks")
 - a. Specifications
 - 1) Have a flat bottom and sufficient width to comply with the minimum bend radius of all cabling as required by the referenced standards and manufacturers recommendations.
 - 2) Be open for easy lay-in and removal of cabling
 - 3) Be designed so the mounting hardware is recessed to prevent cable damage
 - 4) Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3
 - 5) Cable hooks for corrosive areas shall be stainless steel, AISI Type 304
 - 6) Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions
 - 7) Be factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed
 - b. Cable hooks for installation above ceilings shall be
 - 1) B-Line series BCH21, BCH32, BCH64
 - 2) Caddy CABLE-CAT 21 or 32 series hangers
 - 3) Or equivalent from Conditionally Approved manufacturer

C. Conduit

1. Specifications

- a. Refer to Electrical Division 26 for specific product and material information.
 - 1) Sizes, methods, and more stringent requirements shall be adhered to when specified in this Division.
- b. Conduits provided as connection to incoming services, utilities, including private services to other buildings or outside connection points shall be rigid metal or intermediate metal conduit at the point it enters the building, emerges from an exterior wall or ground floor slab to the final termination/transition point.
- c. If services enter a room or space such as a mechanical room, electrical room or other intermediate room due to convenience or proximity to the exterior and adequate space has not been provided within 50 feet for the equipment needed for transitioning these and future cables/services to an appropriately rated indoor cable then those conduits shall be continued uninterrupted (except for necessary pull boxes) to the final connection point or location where the transition point has been designated. Generally this connection point will be a designated Entrance Room for Communications or the Main Telecommunication space. If space has not been identified the contractor shall request information prior to bid.
- d. Follow Electrical Division 26 for conduits underground, in slab or anywhere not within the building.
- e. Provide conduit as indicated on the Drawings or required by this Specification. Minimum conduit size shall be 1 inch for structured cabling. Provide a polypropylene or monofilament plastic line with not less than 200-lb tensile strength in each empty conduit. Permanently mark or tag each conduit or pull box, identifying it as communications (Telecom), AV, TV, Broadcast, Intercom, etc.), at intervals of not more than 75 feet. Each conduit that is stubbed into the ceiling space from an outlet box shall be permanently marked or tagged; refer to Labeling requirements in Section 3 – Execution.
- f. Route an empty conduit from each outlet box into the ceiling space above and terminate with a nylon bushing. In rooms with a non-accessible ceiling, route conduits to the nearest accessible corridor ceiling or communications space.

<u>Number of Structured Cabling Outlets/Connectors</u>	<u>Conduit Size</u>
Up to 4	1 inch
Up to 9	1-1/4 inch

D. Acoustical Pathway

1. Specifications

- a. For use in non-rated walls only.
 - b. For use in place of conduit sleeves through walls of noise critical spaces.
 - c. Plenum Rated (to UL2043)
 - d. Sound Transmission Classification (STC) as tested per ASTM E90 shall be greater than 60.
2. Manufacturer shall be:
 - a. Hilti CS-SL SA
 - b. Specified Technologies, Inc. - NEZ33

E. Surface Raceways

1. The following manufacturers are Conditionally Approved.
 - a. Surface Metal Raceways
 - 1) Hubbell
 - 2) Legrand/Wiremold
 - 3) Mono-Systems Inc.
 - 4) Panduit
 - 5) Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
 - b. Surface Nonmetallic Raceways
 - 1) Hubbell
 - 2) Legrand/Wiremold
 - 3) Mono-Systems Inc.
 - 4) Panduit
 - 5) Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
2. Specifications
 - a. Refer to Electrical Division 26 for specific product and material information.
 - 1) Where a conflict exists between Division 26 and Division 27 the more stringent requirements shall apply.

- b. Raceways shall be sized per the quantity and size of the installed cables, plus 50% spare capacity. Minimum cross-sectional area shall be 1 inch.
 - c. Single gang and double gang surface boxes shall be a minimum of 2-1/2 inches deep.
 - d. Color shall be as directed by the Architect.
3. Manufacturer shall be:
- a. Submit product cutsheet(s) from Conditionally Approved manufacturer listed above.

F. Outlet Boxes

1. Specifications

- a. Boxes shall either be square or rectangular, as noted on the drawings. Dimensions indicate minimum size.
- b. Telecommunications – for outlets shown on ~~T~~- or TN series drawings:
 - 1) For stud walls: dual-gang outlet box shall be a minimum size of 4-11/16 inches width by 4-11/16 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension ring (as indicated on the drawings) a minimum of 3/8" deep. Depth shall match that of wall gypsum board(s).
 - a) Double gang – RACO 258/259 (Coordinate knock-out size with conduit size indicated on drawings); or
 - b) RANDL T-55017; or
 - c) Or equivalent from
 - i) Emerson/Appleton
 - ii) Thomas & Betts/Steel City
 - iii) Approved Substitution
 - 2) For ceilings (flush or above accessible ceiling): *plenum-rated*, dual-gang outlet box shall be a minimum size of 4 inches width by 4 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension ring (as indicated on the drawings) a minimum of 3/8" deep. Depth shall match thickness of gypsum ceiling board(s) or accessible ceiling panel (if applicable).
 - a) Double gang – RACO 239 or equivalent, with ceiling grid framing where installed in accessible ceiling.
 - b) Or equivalent from

- i) Emerson/Appleton
 - ii) Thomas & Betts/Steel City
 - iii) Approved Substitution
- 3) For 6" or 8" deep masonry walls: where single-gang faceplates are shown on the drawings, provide single-gang backbox a minimum of 3-1/2 inches deep; where double-gang faceplates are shown on the drawings, provide double-gang backbox a minimum of 3-1/2 inches deep.
 - a) Single gang – RACO 695
 - b) Double gang – RACO 696
- 4) Weatherproof: Aluminum die cast, weatherproof box with 1" conduit connection. Where single-gang faceplates are shown on the drawings, provide single-gang backbox a minimum of 2-1/2 inches deep; where double-gang faceplates are shown on the drawings, provide double-gang backbox a minimum of 2-1/2 inches deep.
 - a) Single gang – Thomas and Betts – IHD3-3 or equivalent
 - i) Or equivalent from
 - (1) Emerson/Appleton
 - (2) Hubbell/RACO
 - (3) Approved Substitution
 - b) Double gang – Thomas and Betts – 2IHD5-3 or equivalent
 - i) Or equivalent from
 - (1) Emerson/Appleton
 - (2) Hubbell/RACO
 - (3) Approved Substitution
- c. Audio Video – for outlets and boxes shown on TA series drawings:
 - 1) Refer to box schedule on TA series drawings for size requirements.
 - 2) Boxes specifically identified on drawings by manufacturer and model number form the basis of design. Other equivalent manufacturers will be considered, but fully-coordinate proposed alternative with Division 274100 contractor and submit substitution request.

G. Pull Boxes – for interior use only

1. Specifications
 - a. NEMA 1
 - b. Refer to Execution section for sizing requirements.
2. The following manufacturers are Conditionally Approved.
 - a. Hoffman
 - b. NEMA Enclosures
 - c. Wiegmann
 - d. Or Equivalent

2.3 FIRESTOPPING SYSTEMS

A. General

1. All firestopping systems for Division 27 conduit, sleeves, cabling, boxes, etc. shall be from a single manufacturer, unless otherwise noted.
2. The following manufacturers are Conditionally Approved.
 - a. 3M
 - b. Hilti
 - c. Specified Technologies, Inc
3. Communications ladder rack and cable tray shall not continue through a fire-rated wall. Stop the tray, install multiple fire-rated pathway devices, and continue tray on the other side. Ensure grounding of the tray is continuous through the wall.

B. Firestopping for Backboxes in Fire-Rated Walls

1. Specifications
 - a. Used to seal backboxes in fire rated partitions.
 - b. Minimum performance requirements: Shall meet UL testing requirements of UL 263 and classified as Wall Opening Protective Material (QCSN or CLIV); Shall be installed in accordance with the NRTL. Shall meet or exceed the ratings of the wall or floor that it is located in.

- c. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer's instructions.
 - 2. Manufacturer shall be:
 - a. Hilti CP 617 or CFS-P PA
 - b. Specified Technologies Inc., SpecSeal Power Shield
 - c. Or equivalent from Conditionally Approved manufacturer.
- C. Firestopping for Thru-Wall (or Floor) Conduit Penetrations and Other Applications
 - 1. For fire-rated penetrations where the conduit pathway extends beyond a single fire-rated partition/floor, and other required firestopping applications not previously addressed in this specification.
 - 2. Specifications:
 - a. Shall be UL listed for the specific application; Shall meet or exceed the ratings of the wall or floor that it penetrates.
 - 3. Manufacturer shall be:
 - a. Hilti – submit UL System documentation for each floor/wall type and product cutsheets for all Hilti materials to be utilized
 - b. Specified Technologies Inc. – submit UL System documentation for each floor/wall type and product cutsheets for all STI materials to be utilized
 - c. Or equivalent from Conditionally Approved manufacturer.

2.4 ACCESS PANELS

- A. Access Panels
 - 1. Where pullboxes are required above inaccessible ceiling spaces, or for other required conditions, provide an appropriately-sized access panel. The following manufacturers are Conditionally Approved.
 - a. Activar/J.L Industries
 - b. Acudor Products
 - c. Alfab/Barco
 - d. Elmdor Products
 - e. Karp Associates, Inc.

- f. Milcor
 - g. Nystrom Building Products
 - h. Williams Brothers
 - i. Wind-lock
 - j. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
2. Specifications:
- a. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation.
 - b. Joints and seams: continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
 - c. Frames: 16-gauge steel, with a 1 inch wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling:
 - 1) For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
 - 2) For gypsum wallboard or plaster: perforated flanges with wallboard bead.
 - 3) For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
 - d. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
 - e. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
3. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide 2 keys.
4. Indicate proposed size and locations on pre-construction shop drawings. No access panels shall be installed without Architect and Design Consultant approval.

2.5 IDENTIFICATION FOR COMMON WORK FOR COMMUNICATIONS SYSTEMS

A. Labels

- 1. The following manufacturers are Conditionally Approved for generic labeling requirements for conduits, pullboxes, and equipment racks.

- a. Brady
 - b. Brother
 - c. Dymo
 - d. HellermannTyton
 - e. Panduit
 - f. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
2. Specifications:
- a. Refer to additional requirements in Part 3 – Execution.
 - b. Refer to individual sections for additional identification requirements for specific work.

2.6 KEYS

- A. Supply two copies of every key as required for pullboxes, junction boxes, and access panels.

PART 3 - EXECUTION

3.1 PATHWAYS FOR COMMUNICATIONS

- A. General
 1. Refer to Electrical Division 26 for additional installation requirements.
 - a. Where a conflict exists between Division 26 and Division 27 the more stringent requirements shall apply.
 2. All supports shall be specifically designed to support the required cable weight and volume. Field manufactured supports will not be accepted.
 3. Install a pull cord in each pathway (empty or not) for installation of new wires or cables. Use polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inches of slack at each end of pull cord.
 4. Unless otherwise noted, pathway routing shown on the Drawings is illustrative only and meant to indicate the general configuration of the work. Install pathways so that adequate clearances and offsets between pathways and other trades are provided. Coordinate all pathways with other trades prior to installation.

5. All pathways shall include empty space for a minimum of 25% growth beyond initial installation of cabling when contractor performs conduit sizing calculations, otherwise follow conduit sizes indicated on drawings.
6. Cables shall be rigidly supported by cable pathways as indicated on the drawings. Cables shall be physically supported at intervals not to exceed 5 feet.
7. Store and keep dry all products in original container in a climate controlled environment until installation is to occur
8. Install all communications pathways:
 - a. So that cables are allowed to be pulled in accordance with referenced standards and guidelines.
 - b. So that cables are allowed to be pulled without damage to conductors, shield, armor, or jacket.
 - c. So that cables are not forced or allowed to exceed minimum allowed bend radius by manufacturer or referenced standards and guidelines.
 - d. So that the maximum allowable pulling tension is not exceeded.
 - e. To meet the requirements of the structure and the requirements of all other Work on the Project
 - f. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.
 - g. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Architect.
 - h. Parallel or perpendicular to building lines or column lines.
 - i. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
9. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or other methods shall **not** be used to attach cables to cable supports; UON.
 - a. Except when supported by ladder racking within each Telecommunications room, UON.

10. Provide adequate communications pathways so that cabling is not forced to attach, be supported, or use other pathways not specifically designed and provided for communications cabling purposes. Any deviation from this will not be accepted.
 - a. At no point shall cables come in contact with, be supported by, or attach to other trades equipment or supports. UON
 - b. At no point shall cables come in contact with, be supported by, or attach to building structures or supports; UON
11. Provide appropriately sized sleeves where cables are required to pass through non-rated full-height partitions. Where allowed, sleeves shall extend a minimum of 3 inches beyond the partition surface on both sides, and shall be rigidly supported to support the weight of cables. Sleeves shall be sized so that no more than 50% of the cross-sectional area is utilized by the cabling to be installed. The minimum inside diameter of each sleeve shall be nominal 2 inches.
12. Suspended cables shall be installed with at least 3 inches of clear vertical space above the ceiling tiles and support channels (T-bars).
13. Waterproofing
 - a. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
 - b. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.
14. Cutting and Patching
 - a. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc. using skilled tradespeople of the trades required at no additional cost to the Owner.
 - b. Do not cut, channel, chase or drill masonry, tile, etc., unless permission from the Architect is obtained. If permission is granted, perform this work in a manner acceptable to the Architect.
 - c. Patch around all openings to match adjacent construction.
 - d. Where conduit or equipment is mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

- e. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.
- f. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

15. Mounting Heights

- a. Mounting heights for equipment and devices requiring operational access shall conform to ADA requirements.
 - 1) Wall mounted devices requiring operational access shall be mounted a minimum of 15 inches above finished floor to bottom of device and a maximum of 48 inches above finished floor to top of device.
- b. Mounting heights shall be from floor to center of device, unless otherwise noted. Verify exact locations and mounting heights with the Architect before installation.
- c. Typical mounting heights shall match nearest adjacent typical electrical outlet mounting height UON or as directed by the Architect.

16. Painting

- a. Refer to Division 9 Section "Painting" for painting requirements.
- b. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under individual Sections; colors shall be as selected by the Architect.
- c. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.
- d. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.
- e. Where factory finishes are provided and no additional field painting is specified, touch-up or refinish, as required by, and to the acceptance of, the Architect and Design Consultant, marred or damaged surfaces so as to leave a smooth, uniform finish. If, in the opinion of the Architect or Design Consultant, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.
- f. Provide touch-up paint as required by Specification Sections in this Division.

17. Fastenings

- a. Fasten equipment to building structure in accordance with the best industry practice.
- b. Where weight applied to the attachment points is 100 pounds or less, conform to the following as a minimum:
 - 1) Wood: Wood screws.
 - 2) Concrete and solid masonry: Bolts and expansion shields.
 - 3) Hollow construction: Toggle bolts.
 - 4) Solid metal: Machine screws in tapped holes or with welded studs.
 - 5) Steel decking or sub-floor: Fastenings as specified below for applied weights in excess of 100 pounds.
- c. Where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following as a minimum:
 - 1) At concrete slabs provide 24 inch x 24 inch x ½ inch steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.
 - 2) At steel decking or sub-floor for all fastenings, provide through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with his decking or sub-floor such hangers shall be provided.
- d. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Architect and conform to the following as a minimum:
 - 1) Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- e. For items, which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- f. Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels as manufactured by Kindorf or Unistrut are acceptable.

- g. Bridle rings are prohibited for Division 27 cables, unless otherwise noted on drawings.
 - 18. For large quantities of cables (greater than 50) that converge upon a common run such as at a rack, in corridors, and other areas, provide cable trays or other special supports that are specifically designed to support the required cable weight and volume.
 - 19. Areas identified as noise critical spaces shall have all penetrations sealed to minimize sound transmission between adjacent spaces. Install Acoustical Pathway(s) through walls of noise critical spaces
- B. Access to pathways and associated equipment
- 1. Locate all cable trays, open hanger cable supports, j-hooks, pull boxes, junction boxes and fire stopping systems so as to provide easy access for operation, service inspection and maintenance.
 - 2. Provide an Access Panel where equipment or devices are located above inaccessible ceilings. Where access doors are necessary but not shown on the plans, coordination type and location with Architect and Design Consultant through an RFI.
 - a. Pathways requiring access such as open hanger cable supports, j-hooks, and cable trays shall have an access door or other means of direct access at a minimum of 10 feet intervals.
 - b. Cables or cable pathways requiring access such as open hanger cable supports, j-hooks, and cable trays may not change directions above an inaccessible ceiling unless complete access to the change of direction in pathway or cable route is within arms reach 3 feet from adjacent accessible point.
 - 3. Maintain all code required clearances and clearances required by manufacturers.
- C. Cable distribution
- 1. Provide pathways for Telecommunications (Structured Cabling System) to allow cabling to be installed in the following manner:
 - a. For typical new walls:
 - 1) Conduit from outlet location to accessible ceiling then j-hooks to main run of cable tray.
 - b. For existing walls:
 - 1) For stud walls - "Ring and String": Mud ring for faceplate, cabling run in hollow cavity of the wall and then j-hooks are utilized back to the nearest cable tray or serving Telecommunications Room/Space

- 2) For masonry or inaccessible walls – Surface-mounted raceway to accessible ceiling space.
 - c. For phone and data lines to all Elevator Equipment Rooms and Fire Alarm panels:
 - 1) Homerun method: Conduit from outlet location all the way back to the Telecommunications Room/Space.
 - d. See drawings for clarification
 - 2. Provide pathways for Audio Video Systems to allow cabling to be installed in the following manner:
 - a. For typical new walls:
 - 1) Homerun method: Conduit from outlet location to accessible ceiling then j-hooks to conduit in wall for AV Rack.
 - b. For existing walls:
 - 1) For stud walls - "Ring and String": Mud ring for faceplate, cabling run in hollow cavity of the wall and then j-hooks are utilized back to the nearest cable tray or serving Telecommunications Room/Space
 - 2) For masonry or inaccessible walls – Surface-mounted raceway.
 - c. See drawings for clarification.
- D. Conduits
- 1. Conduit shall be of the appropriate type required by code and as required by Electrical Division 26.
 - 2. Adequate access shall be available where cables enter conduits
 - 3. Bond and ground all metallic conduits and boxes in accordance with national or local requirements and with TIA-607D – "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.
 - 4. Install conduits in the most direct route possible, running parallel to building lines
 - 5. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
 - 6. Conduits which enter Telecommunications rooms shall extend 3 inches AFF or through the wall.
 - 7. Conduits which enter Entrance Facilities shall extend 4 inches AFF or below the finished ceiling (if exists).

8. Flexible conduits may only be used where specifically allowed by these contract documents.
 - a. Flexible conduit sections shall be less than 20 feet in length.
9. No continuous section of a conduit may exceed 100 feet without a pullbox.
10. For structured cabling, no more than (2) 90° bends, or equivalent will be allowed between pullboxes.
 - a. Each and any offset shall be considered a 90° bend.
 - b. A pullbox is required wherever a reverse bend is installed.
11. The minimum bend radius for conduits is
 - a. (6) times the inside diameter for 2 inches conduits or less.
 - b. (10) times the inside diameter for conduits greater than 2 inches.
12. Any single conduit run may not serve more than (1) outlet location unless expressly indicated on the drawings.
13. Where building entrance conduits (for service provider and owner's WAN cabling) do not enter the building directly into the Communications Entrance Room/Facility, extend those entrance conduits via RMC or IMC into the Communications Entrance Room/Facility.
 - a. Coordinate with Contractor for Division 27 Sections "Communications Backbone Cabling" and "Communications Horizontal Cabling" for potential other pathways where IMC/RMC are required.
14. Conduits shall contain no electrical condulets (also known as LBs).
 - a. Exception: Pre-approved (by the Design Consultant) condulets specifically manufactured for communications cabling and will maintain minimum bend radius for cabling to be installed. These locations are to be called out on the shop drawings.
15. Underground Conduit Requirements
 - a. For Structured Cabling System horizontal cabling and pathways within the footprint of the building and serving voice and data outlets exterior to the building, such as emergency phones/towers, security cameras and wireless access points attached to exterior light poles, etc
 - b. For Audio Video System cabling serving pole-mounted loudspeakers, broadcast boxes, etc.
 - c. Requirements

- 1) Refer to applicable details on drawings for illustrative requirements.
- 2) Wherever practical, slab-on-grade floorboxes shall have conduit extended underground or in-slab from box to serving communications room or equipment cabinet.
 - a) Only one horizontal bend is allowed, 90 degrees or less.
 - b) Indicate proposed routing and stub-up locations on shop drawings.
- 3) Route all underground conduit so there is no more than (3) 90 degree bends, including stub-up bend at communications room/equipment cabinet.
 - a) For underground conduit serving outlets/boxes outside the footprint of the building that require more than (3) 90 degree bends, provide appropriately-sized handhole(s). Coordinate location with Architect and Owner, indicate proposed location(s) on shop drawings, and include product information in pre-construction submittals. In general, handholes are not to be located in roadways, parking lots, sidewalks, or any location that may be subject to vehicular traffic.
- 4) Approved conduit types:
 - a) When routed in slab-on-grade:
 - i) Horizontal conduit shall be RMC or Schedule 40 PVC, including horizontal bends. If PVC is installed, also install tracer wire.
 - ii) Vertical bends shall be RMC.
 - b) When routed below slab-on-grade or outside the footprint of the building:
 - i) Horizontal conduit shall be RMC or Schedule 40 PVC a minimum of 12" below grade. If PVC is installed, also install tracer wire.
 - ii) All vertical and horizontal bends shall be RMC.
16. Install approved expansion/deflection fittings where raceways pass through or over building expansion joints.
17. Route raceway through roof openings for piping and ductwork or through roof seals approved by the Architect, the roofing contractor, or both. Obtain approval for all roof penetrations and seal types from the Architect, Owner, roofing contractor, or all three as required to maintain new or existing roofing warranties.

E. Outlet boxes

1. No outlet boxes shall be located back-to-back in a wall cavity.
 - a. Where possible offset to next stud cavity, with a minimum of 6 inch separation.
2. Outlet boxes shall be within 3 feet of nearest electrical outlet.
3. Outlet boxes located in fire-rated walls are to have the appropriate firestopping for backboxes. These locations are to be identified on shop drawings.
4. Where cabling enters a backbox directly (not via conduit), provide black rubber grommet on knockout.

F. Pullboxes

1. Pullboxes shall be placed in Conveniently Accessible locations.
2. Coordinate the location and installation of all pullboxes to ensure adequate access is provided.
3. Pullboxes above an accessible ceiling shall:
 - a. Be aligned directly over the ceiling grid to allow access
 - b. Be installed with a minimum of 3 inches clearance to ceiling grid and tiles
4. No directional changes shall be allowed in pullboxes. Conduit Shall continue in the same direction as it enters and then change direction via an appropriately sized bend in the conduit.
5. Size pullboxes according to the following chart (all sizes are minimums):

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit (of same size)
1" or smaller	4"	4"	2-1/8"	Not applicable
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	27"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	8"

G. Cable Tray

1. Cable trays shall be installed in accordance with the applicable electrical code and standards.
2. The inside of the cable support system shall be free of burrs, sharp edges or projections that can damage cable insulation. Abrasive supports (e.g., threaded rod) installed within

the cable fill area shall have that portion within the tray rigidly protected with a smooth, non-scratching covering so that cable can be pulled without physical damage such as appropriately rated (plenum) plastic tubing.

3. Cables shall remain unattached to its pathway and shall simply lay at rest on the supports provided by its pathway. Wire ties, velcro straps, electrical tape or other methods shall **not** be used to attach cables to cable supports; UON.
4. Installation of cables shall not exceed the fill requirements stated above.
5. Cable trays shall not extend through fire-rated walls and walls for noise critical spaces.
6. Cable trays shall not extend over 6' lengths (or greater) of inaccessible ceilings. Stop cable trays just before the inaccessible ceiling and provide overhead conduits of quantity and size bridging the two sections of cable tray so that conduit cable capacity (square inches per fill ratio) is equal to that of the cable tray.
 - a. The cable fill ratio for cable tray shall be 50%.
 - b. The cable fill ratio for conduits shall be 40%.
 - c. Example: a 4" x 12" cable tray has 48 square inches of total capacity, and 24 square inches of cable capacity. Per the NEC, a 4" trade size EMT conduit has a 40% cable capacity of 4.62 inches. 24 divided by 4.62, rounding up to the next whole number equals (6) 4" conduits shall be provided for a 4" x 12" cable tray.
7. Cable trays and cable runways shall not be used as walkways or ladders.
8. A minimum of 12 inches access headroom shall be provided and maintained above a cable tray system or cable runway.
9. Care shall be taken to ensure that other building components (e.g., air conditioning ducts, pipes, conduits) do not restrict access.
10. Basket cable trays shall be supported according to manufacturer's instruction via one of the following:
 - a. Trapeze/Unistrut under the cable connected to the cable tray and to (2) 3/8" (or greater) rods to structure above.
 - 1) Center-hung, single-rod supports are not allowed.
 - b. Shelf or L-brackets attached to wood or metal studs.
11. Test cable tray systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with maximum grounding resistance.

3.2 LABELING

A. Labeling Installation

1. Labels that are to be secured by adhesive. They shall have a type of adhesive that is appropriate for the particular surface upon which the label is to be installed. The mounting surface shall be free of dust, dirt, oil, etc. that would impede the adhesion of the labels.

B. Labeling Requirements

1. Labels are to be installed on:
 - a. All firestopping systems. For wall and floor penetrations, label on both sides. See Firestopping later in this section. Take picture of each firestopping system (with label visible) to include with Project Completion submittal.
 - b. All pathways (e.g., conduit, innerduct, etc.) installed under this work.
 - 1) Label all conduit and innerduct with "TELECOM" or "AV" according to the intended system/use of the installed (or future) cabling. Conduit labels shall utilize text readable from a standing position on the finished floor. Conduit sleeves which pass through a single wall or floor need not be labeled.
 - a) For wall stub-up locations, label overhead only.
 - b) For conduits greater than 10', label both ends of conduit with far end location and Room/Number.
 - i) Example – "AV to AV Rack R01".
 - c) For conduits that stub directly up or into a Communications Room, label both ends of conduit.
 - i) Example: underslab conduit from Telecom Room 1A to the Floor Box in Confence Room 101A shall be labeled as follows:
 - (1) Conduit stub-up location in Telecom Room 1A – "Telecom to Conf. Rm 101A Floorbox"
 - (2) Bottom of floorbox, immediately adjacent to serving Telecom conduit – "Telecom to Telecom Room 1A"
 - 2) All pullboxes and junction boxes for Communications shall be labeled such as "TELECOM PULLBOX", "AV JUNCTION BOX", "TV", etc. on the cover, such that the text is of sufficient size to be readable from a standing position on the finished floor.

- a) Conduits entering and exiting all pullboxes and junction boxes shall be labeled with their destination/room number – ie “To AV Box Q:212:01 in Control Rm 212”.
- c. In general, the label is to be provided and installed by whomever installed the item that is being labeled.
- d. Refer to individual Division 27 Communications sections and to the drawings for additional information on labeling requirements.

3.3 FIRESTOPPING

A. General

1. Provide fire-resistant materials of a type and composition necessary to restore fire ratings to all wall, floor or ceiling penetrations; including membrane penetrations. All materials shall be classified or listed as a complete system by UL (or an approved NRTL by the Design Consultant and AHJ) and meet NEC and local codes. The use of partial systems or components of systems is not allowed unless specifically identified in the documents.
2. All penetrations through fire rated floors and walls shall be sealed to prevent the passage of smoke, flame, toxic gas or water through the penetration before, during or after a fire. The fire rating (F and T) of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by referenced building codes.
 - a. Assume all floors are fire-rated, unless otherwise noted.
 - b. Also install fire stops at any other locations indicated in the Specifications or Drawings.
3. Provide a label on both sides of fire rated assembly at all fire stop locations indicating:
 - a. Fire stop Manufacturer
 - b. Installer and company
 - c. Date installed
 - d. UL system number with all relevant ratings indicated
4. Include labels in each telecom room in which one or more fire rated walls is installed. Provide a 2” block letter stencil label on the inside of the telecom room to indicate rating for each barrier.
5. Provide systems as identified on the drawings and specified herein. At locations where the cabling routing encounters a fire-rated barrier provide an adequately sized fire stop device for the quantities and types for all cables to be installed plus 25% growth.

B. Penetration Sealant – Conduits

1. Provide listed system to seal around openings between wall, floor or partition around conduits in accordance with system listing and manufacturer's instructions.

C. Penetration Sealant – Voids, Cavities, and Openings

1. Install fire stop materials in the framed openings through fire rated partitions per the Architect's drawings and in accordance with the NRTL listed system instructions.
2. Fire stop all voids, cavities, and openings left by the removal of cabling, conduits, conduit sleeves, cable trays or other equipment related to the communications systems not to be reused.
3. Install the fire stop system in accordance with the manufacturer's instructions and local codes.

D. Fire-Rated Pathway Device

1. Provide fire-rated pathway device anywhere cables are required to pass through fire-rated walls, floors or partitions.
2. Devices shall be installed in locations where required by the Contract Drawings, arranged individually or appropriately ganged.
3. Install the devices in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
4. Apply the factory supplied gasketing material (where required) prior to the installation of the wall plates.
5. Secure wall plates (where required) to devices per the equipment manufacturer's recommendations.

END OF SECTION 270500

SECTION 271000 - STRUCTURED CABLING SYSTEM

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Provide a complete functioning telecommunications structured cabling system, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.
- B. Specification sections 271000 through 271999, and Drawings numbered with prefix TN, generally describe these systems, but the scope of the Structured Cabling System Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing, Electrical, Communications, and Electronic Safety and Security Drawings and Specifications; and Addenda.
- C. This section includes additional requirements for the Structured Cabling (Telecommunications) System, which include the following:
 - 1. Quality Assurance requirements, including Contractor qualifications and advanced warranties

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Division 27 Section "General Communications Requirements".
- C. Division 27 Section "Common Work Results for Communications".
- D. Requirements of this Section apply to all Sections 271000 through 271999.

1.3 STANDARDS

- A. The references to the following standards represent the most current and up-to-date revisions or printing as of the issue of this document including all sections, parts and their addenda. The Contractor is responsible for following the correct revision or printing (UON):
 - 1. ANSI/TIA-568 – "Commercial Building Telecommunications Cabling Standard Set"

2. ANSI/TIA-569 – “Commercial Building Standard for Telecommunications Pathways and Spaces”
3. TIA-526 – “Standard Test Procedures for Fiber Optic Systems”
4. TIA TSB 140 – “Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems”
5. ANSI/TIA-606 – “Administration Standard for Commercial Telecommunications Infrastructure
6. ANSI/TIA-607 – “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
7. ANSI/BICSI/NECA 568 – “Standard for Installing Commercial Building Telecommunications Cabling”
8. ANSI/TIA-758 – “Customer-Owned Outside Plant Telecommunications Cabling Standard”

1.4 GUIDELINES

- A. The references to the following guidelines represent the most current and up-to-date revisions or printing as of the issue of this document including all sections, parts and their addenda. The Contractor is responsible for following the correct revision or printing (UON)
 1. BICSI Information Technology Systems Installation Methods Manual (ITSIMM)
 2. BICSI Telecommunications Distribution Methods Manual (TDMM)
 3. BICSI Outside Plant Design Reference Manual (OSPDRM)

1.5 DEFINITIONS

- A. BICSI - Building Industry Consulting Service International
- B. Structured Cabling System – the physical infrastructure installed to support information technology/transport for voice and data applications, commonly referred to as a Telecommunications System. This includes, but is not limited to: Category 3/5e/6/6A copper cabling, terminations/blocks, modules, faceplates, etc., and optical fiber cabling, terminations, modules, etc.
- C. Wet Location - as defined in the NEC, installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.6 QUALITY ASSURANCE

A. Personnel Qualifications:

1. Provide and maintain a BICSI Registered RCDD in good standing on staff as a full-time employee at all times. This RCDD shall be familiar with the project and available to attend all scheduled project meetings when required by the Owner/Design Consultant. Weekly inspections and approval of all work performed shall be conducted by this RCDD.
2. Provide and maintain a Project Manager whom is a BICSI Registered Certified Technician Level 2 Installer in good standing on site at all times. This project manager shall attend all scheduled project meetings and be responsible for all submittals.
3. The person(s) conducting the testing for all Telecommunications cabling shall be a current BICSI Certified Level II Commercial Installer or higher.
4. Any additional personnel that will be physically installing any part of the Telecommunications Infrastructure covered by this Division shall, at a minimum, be a BICSI Certified Level 1 Commercial Installer in good standing or have equivalent manufacturer training certificate (of those identified as approved for this project) and approved by the Design Consultant.
5. These requirements are provided as a minimum level of qualification. Any additional or more stringent requirements by the specific manufacturer chosen to provide the proper level or term of warranty as specified in this division shall be met.
6. Alternate qualifications may be considered if requested alternates are provided in accordance with the substitution section herein prior to bid.

B. Contractor qualifications:

1. Provide a list of projects (no less than 2) of similar size, scope and type in which the Bidder has performed in a capacity comparable to the size, scope and type outlined in these Construction Documents. Provide the project name, relevant project information for comparison evaluation, and contact names with telephone numbers of each such project.

1.7 ADVANCED STRUCTURED CABLING SYSTEM WARRANTY

- ### A.
- All components, including but not limited to, connectors, terminal blocks, cabling and all other components considered to be a part of what is commonly referred to as an end-to-end solution for all backbone and horizontal cabling systems, shall be warranted for a minimum period of 15 years from the date of installation against defects in materials, equipment and workmanship. This warranty shall also include the performance of these systems. This warranty shall include transmission requirements as specified in applicable ANSI/TIA/IEC/ISO standards for each cable system specified. This warranty shall also include all current and future applications designed for and becomes available under warranty for each cable system.

1. Warranty shall be guaranteed by a single reputable manufacturer from below:
 - a. Belden Incorporated
 - b. CommScope Inc.
 - c. Corning Cable Systems (for Fiber portion only)
 - d. Hubbell
 - e. Legrand/Ortronics
 - f. Leviton
 - g. Panduit
 - h. Siemon
 - i. Superior Essex Cabling
 - j. Or Approved Substitution (submitted and accepted in the pre-bid submittal)
- B. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.
- C. Perform the remedial work promptly, upon written notice from the Architect or Owner.
- D. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.8 WORK INCLUDED

- A. Provide labor, materials, and accessories required to provide complete, operating Telecommunications Infrastructure systems as called for in the Contract Documents and in accordance with applicable codes and regulations. Labor, materials or accessories not specifically called for in the Contract Documents, but required to provide complete, operating infrastructure systems shall be provided without additional cost to the Owner. The work includes, but is not necessarily limited to, the following:
 1. All horizontal cabling between the Telecommunications rooms and the outlets.
 2. All termination blocks, outlets/jacks, patch panels, cabinets, equipment racks, etc., required to support, terminate and/or cross connect cabling at the main cross-connect, Telecommunication rooms and/or other designated equipment locations.
 3. All physical cable management hardware including, but not limited to: "J-hooks" in accessible ceiling areas, cable trays, conduits, ladder-type cable racks within

telecommunication rooms and "D-rings" on backboards and equipment racks/cabinets/frames.

4. A Grounding/Bonding System, as described in these construction documents.
5. Termination, cross connect and patching of all cable pairs as indicated herein or on schedules or on drawings.
6. Testing, labeling and documentation of all cables and hardware installed under this contract.
7. Preparation and submission of shop drawings, testing reports, as-built drawings, and cabling documentation as described below.

1.9 COORDINATION

- A. The locations of cable termination fields, outlets, patch panels, equipment racks and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- B. Exercise particular caution with reference to the location of outlets, patch panels, control panels, switches, etc., and have precise and definite locations accepted by the Architect before proceeding with the installation.
- C. The Drawings show only the general run of raceways and approximate locations of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Architect for review before such alterations are made. Modifications shall be made at no additional cost to the Owner.
- D. Verify with the Architect the exact location and mounting height of outlets and equipment not dimensionally located on the Drawings.
- E. Outlet/cable tags in the form of alpha/numeric characters are used where shown to indicate the outlet and cable designation numbers in cable termination fields (terminal blocks and/or patch panels). Show the actual outlet/cable numbers on the as-built drawings, on the associated typed termination field labels and in the printed and computer readable cabling schedules. Where sample outlet/cable-numbering information is not indicated, request clarification from the Architect.
- F. The drawings generally do not indicate the number of cables in conduit, or the actual identity of cables in specific conduits, cable tray or other cabling pathways. Provide the correct cable type and quantity as required by the indicated outlets, cable schedules, the design intent of any example drawings or schedules, referenced wiring diagrams (if any), the maximum distance limitations, and the applicable requirements of the NEC and ANSI/TIA-568.

- G. Adjust location of conduits, terminal blocks, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
 - 1. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 - 2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.

1.10 SUBMITTALS

- A. Refer to requirements in Division 27 Section "General Communications Requirements". At a minimum, include the following items:
 - 1. Pre-bid submittal
 - a. Product substitutions, approved alternate or equivalent requests to be reviewed for approval (Prior to Bid)
 - b. Alternate personnel credentials to be reviewed for approval
 - 2. Bid submittal
 - a. Bid Response Forms
 - b. Personnel Qualifications / Credentials - Supplemental to Division 1 requirements submit the following documents to indicate the required personnel qualifications per the quality assurance section of this section:
 - 1) Member of staff required to be RCDD
 - a) A copy of their valid RCDD certificate, RCDD number, and BICSI member number shall be provided with bidding documents.
 - 2) On-site project manager
 - a) A copy of their valid BICSI Certified Technician certificate and BICSI member number shall be provided with bidding documents.
 - 3) Other personnel physically installing any portion of the Communications infrastructure
 - a) A copy of their valid BICSI Commercial Installer certificate and BICSI member number shall be provided with bidding documents

- b) An alternate certification may be considered by the Design Consultant for approval, which shall be completely at the Design Consultant's discretion.
 - c) If the contractor chooses to submit an alternate certification from one of the conditionally approved vendor list as an acceptable alternate for a BICSI Commercial Installer, the following shall be included:
 - i) A valid copy of each certification with the person's name and member number including the manufacturer's logo
 - ii) A document provided by the manufacturer describing what specific subjects the certification covers, period of time spent doing course work required to gain certification, exam topics, and the requirements needed to maintain the certification.
 - 4) Contractor Qualifications (Previous project references)
 - 5) Voluntary Bid Alternates
 - 3. Pre-construction submittal
 - a. Warranty information
 - 1) Sample warranty certificate for the Advanced System Warranty, indicating manufacturer and terms/conditions
 - 2) Proof that Contractor is certified with the Advanced System Warranty manufacturer
 - b. Resubmit Contractor and Personnel Qualification, update if necessary
 - c. A typed list, indexed by Specification section, of products specifically identified by part number (no wild card characters) within each specification section in this Division. Order shall match that as in these specifications.
 - d. Manufacturers' cut-sheets, in same order as typed list and in these specifications.
 - 1) At a minimum all cut-sheets shall contain the following:
 - a) Cross-reference to the specification section and/or drawings for which the product is to be reviewed for compliance and acceptance
 - b) Every product cut-sheet submitted for review shall contain the manufacturers' name and logo
 - c) All parts, pieces, and equipment submitted for review shall be identified specifically by stamp, or highlighted in such a manner that

the product(s) being considered are clearly identifiable and distinguished from all other materials, parts or equipment that may be on the submittal.

- d) For cut-sheets with accessories, additional parts, or derivations of the product being submitted all shall be clearly identified for the reviewer and acceptance.
- e) Sufficient detail for reviewer to identify all required information, such as size, weight, color, NRTL listings, approval or certification information, and other necessary identifying information to confirm product meets specifications.

e. Shop Drawings

f. And as required by individual sections in this Division

4. Project completion submittal

a. Preliminary Project Completion submittal requirements:

1) To be submitted:

- a) After all horizontal and backbone cabling has been installed, terminated, labeled, tested, and corrected so that all cables and strands pass the Testing Requirements.
- b) In conjunction with the Substantial Completion Review request.
 - i) Design Consultant requires a minimum of 1 week notice to schedule the on-site Substantial Completion Review.
 - ii) Substantial Completion Review shall be a minimum of 1 weeks before Substantial Completion, or earlier if the Project Schedule requires it, to allow for major Punch List items to be address by Contractor.

2) Submittal shall include:

- a) Scanned Work Site Prints that include horizontal and backbone cable/outlet labels that correspond to the Test Results.
- b) Passing Test Results for all cables and strands, in the following formats:
 - i) Abbreviated Test Results in Excel or CVS file format, shown in numerical/alphabetical order, with the following information:

(1) Project Name

- (2) Date of Preparation
 - (3) ID of Work Area Outlet / connector being tested
 - (4) Date of test
 - (5) Contractor's Name
 - (6) Media Type
 - (7) Make, Model, and Serial Number of test equipment used
 - (8) Date of last calibration
 - (9) Names of test crew
 - (10) Serving Telecommunications Room Number (all tests shall be submitted in numerical / alphabetical order by Telecommunications Room)
 - (11) Category or type of cable being tested
 - (12) Pass or Fail status
- ii) Full Test Results in the original file format of the tester (example: .mdb file), shown in numerical/alphabetical order, with the following information:
- (1) Project Name
 - (2) Date of Preparation
 - (3) ID of Work Area Outlet / connector being tested
 - (4) Date of test
 - (5) Contractor's Name
 - (6) Media Type
 - (7) Make, Model, and Serial Number of test equipment used
 - (8) Date of last calibration
 - (9) Names of test crew
 - (10) Serving Telecommunications Room Number (all tests shall be submitted in numerical / alphabetical order by Telecommunications Room)

(11) Category or type of cable being tested

(12) Full Test Result Data (per Part 3 of this specification)

b. Final Project Completion submittal requirements:

- 1) Advanced Structured Cabling System Warranty Certificate. Warranty terms and conditions shall contain the following:
 - a) Length of warranty period
 - b) Applications covered (future and present)
 - c) Single manufacturer responsible for fulfilling warranty
 - d) Who is covered
 - e) What is covered
 - f) All disclaimers, limitations, etc.
 - g) What, if anything, is not covered
- 2) Product Information
 - a) Product List (Bill of Materials) – a typed list of products (in order of these specifications), in Excel or CSV file format, indicating:
 - i) Product Type (as identified in these specifications)
 - ii) Manufacturer
 - iii) Model Number
 - iv) Quantity installed
 - v) Serial Number (if applicable)
 - vi) Manufacturer Warranty date (if longer than 1 year)
 - b) Manufacturer Cut Sheets / Specification Sheets
 - c) Operation and Maintenance Manuals – manufacturer's installation, service, and maintenance instructions.
 - d) Warranty certificates (for products not covered by the Advanced System Warranty)
 - i) If products require registration, register on the Owner's behalf.
- 3) As Built Drawings

- a) At the completion of the project, incorporate changes to the Structured Cabling System noted on the jobsite work prints onto a set of as built Drawings. These changes shall be done electronically and saved to PDF format.
 - b) Include date and installing contractor's logo and contact information in the title block.
 - c) Mark each sheet "As Built Drawing".
 - d) Drawings shall include:
 - i) Corrected items from Substantial Completion Review punch list.
 - ii) Cable ID (all characters) for each work area outlet jack (so that they are searchable in the PDF version)
 - iii) Routing of cable/conduit/cable tray and location of any firestopping systems and pull boxes.
- 4) Updated, complete Test Results in the following formats (to include the retesting data of any cables installed or modified after Preliminary Project Completion submittal):
- a) Abbreviated Test Results in Excel or CVS file format, shown in numerical/alphabetical order, with the following information:
 - i) Project Name
 - ii) Date of Preparation
 - iii) ID of Work Area Outlet / connector being tested
 - iv) Date of test
 - v) Contractor's Name
 - vi) Media Type
 - vii) Make, Model, and Serial Number of test equipment used
 - viii) Date of last calibration
 - ix) Names of test crew
 - x) Serving Telecommunications Room Number (all tests shall be submitted in numerical / alphabetical order by Telecommunications Room)

- xi) Category or type of cable being tested
 - xii) Pass or Fail status
 - b) Full Test Results in the original file format of the tester (example: .mdb file), shown in numerical/alphabetical order, with the following information:
 - i) Project Name
 - ii) Date of Preparation
 - iii) ID of Work Area Outlet / connector being tested
 - iv) Date of test
 - v) Contractor's Name
 - vi) Media Type
 - vii) Make, Model, and Serial Number of test equipment used
 - viii) Date of last calibration
 - ix) Names of test crew
 - x) Serving Telecommunications Room Number (all tests shall be submitted in numerical / alphabetical order by Telecommunications Room)
 - xi) Category or type of cable being tested
 - xii) Full Test Result Data (per Part 3 of this specification)
- B. Each structured cabling section (271000-271999) shall be submitted individually. All structured cabling section submittals (271000-271999) shall be submitted on the same date. "Piecemeal" submissions will not be reviewed.
- C. For each room or area of the building containing Structured Cabling System infrastructure and equipment, submit the following as part of the shop-drawings and as-built drawings:
 - 1. Floor plans, at not less than 1/8" scale, showing routing of Communications conduits, cable trays, and wireways, including surface-mounted raceways and pullboxes. Also show the routing of bundles of cables supported by "J-hooks", or similar means, if and where such installation practices are allowed by the Contract Documents.
 - a. Outlet locations shall be identified with jack/module type and label. Coordinate labeling scheme with Owner prior to submitting.

2. Riser diagrams showing types, quantities and schematic routing of all Communications backbone pathways, cabling and the TBB and TBC.
 3. Enlarged plan views and elevation layout drawings for the Telecommunications Entrance Facility Room, Telecommunications Rooms and all other designated Telecommunications Equipment Rooms indicating the equipment in the exact location in which it is intended to be installed. These plans shall be of a scale not less than $\frac{1}{4}$ inch = 1'-0". They shall be prepared in the following manner:
 - a. Indicate the physical boundaries of the space including door swings and ceiling heights and ceiling types (as applicable).
 - b. Illustrate all Communications equipment proposed to be contained therein. The Drawings shall be prepared utilizing the dimensions contained in the individual equipment submittals. Indicate code and manufacturer's required clearances.
 - c. Illustrate all other equipment therein such as conduits, detectors, lighting fixtures, ducts, registers, pull boxes, wireways, structural elements, etc.
 - d. Indicate the operating weight of each piece of equipment.
 - e. Indicate dimensions to confirm compliance with code-required clearances.
 - f. Indicate maximum normal allowable operating temperature for each piece of equipment (as per each respective manufacturer's recommendation). (Note: This requirement applies to active Communications equipment such as LAN hubs, routers, amplifiers, radio transmitters/receivers, PBX or key telephone equipment, etc., if installed under this work.)
 - g. Equipment removal routes for individual equipment items with plan dimensions exceeding 24" by 36" or height exceeding 84".
 - D. The Communications Equipment room layout submittals and the related Structured Cabling System submittals shall be submitted concurrently. Failure to submit concurrently may result in the immediate return of the submittal marked REVISE AND RESUBMIT.
- 1.11 SPARE PARTS
- A. Furnish to the Owner the following spare parts as part of the complete Structured Cabling System:
 1. Furnish one general purpose 110-style punch down tool.
 2. Any custom or proprietary copper Category cable termination tool. Furnish one per Communications Room.
 3. Additional Special Tools, as defined in Part 3 of this specification.

- B. Have these spare parts in the Main Communications Room during Design Consultant's Site Observation Review visit; turn over to Owner before Substantial Completion.

PART 2 - PRODUCTS

2.1 110-STYLE PUNCHDOWN TOOL

- A. Manufacturer shall be Panduit PDT-110 or equivalent.

2.2 COPPER TESTING EQUIPMENT

- A. Category 6 Cable Tester

- 1. Available Manufacturers. Contractor may submit other cable testers that meet specification requirements.
 - a. Category 6 Cable Tester
 - 1) Fluke
 - 2) Ideal
 - 3) Softing
 - 4) Viavi
- 2. Requirements
 - a. The field tester shall be a level III or greater.
 - b. The field tester shall meet the requirements of ANSI/TIA-568.

- B. Augmented Category 6 Cable Tester

- 1. Available Manufacturers. Contractor may submit other cable testers that meet specification requirements.
 - a. Augmented Category 6 Cable Tester
 - 1) Fluke
 - 2) Ideal
 - 3) Softing
 - 4) Viavi
- 2. Requirements

- a. The field tester shall be a level III-E (IIIe) or greater.
- b. The field tester shall meet the requirements of ANSI/TIA-568.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 IDENTIFICATION / LABELING

A. General

1. Labels or tags containing a unique cable ID designator as specified on the drawings or herein shall be placed on both ends of all cables, 6 inches (152.4 mm) from the connector and/or terminal block.
2. Label or tag all cables passing through Telecommunications rooms.
3. Subsequent to placing and terminating cables, place the appropriate cable label.
4. The administration of the Telecommunications infrastructure includes:
 - a. Labels (plates, tags, etc.) to identify individual components.
 - b. Schedules (or other records (printed and/or in computer data base form) to document information about the individual components and the relationships between them.
 - c. Plans or drawings to assist with visualizing the physical and/or logical locations of the components.
5. Provide labels on all applicable items installed under this work and to provide all related records and drawings so that the Owner will be able to administer the Telecommunications infrastructure.

B. Labeling Installation

1. Labels that are to be secured by adhesive shall have a type of adhesive that is appropriate for the particular surface upon which the label is to be installed. The mounting surface shall be free of dust, dirt, oil, etc. that would impede the adhesion of the labels.
2. Labels, plates and tags are to be installed in such a manner that they will be accessible, both physically and visually, after completion of the work. (Exception: It is understood that labels on the outlet end of station cables are generally not visible unless the face plates, bezel, module, etc., is removed or opened.)

3. Any temporary labels used during installation, cable pulling, etc. are to be removed and replaced by the permanent labels identified in Part 2 of this specification before the work will be accepted.
4. If at any time during the job the cable tag becomes illegible or removed for whatever reason during the construction period, immediately replace it with a duplicate pre-printed cable tag at the Contractor's expense before the work will be accepted.

C. Labeling Requirements

1. Labels, plates and tags are to be installed on:
 - a. All Telecommunications rooms (spaces).
 - b. All horizontal links and their components, including:
 - 1) Attaching a label no more than 6 inches (152.4 mm) from both ends of all horizontal cables installed under this work.
 - 2) Labeling/Color Coding of cable termination hardware (terminal blocks, outlets, patch panel jacks, etc.) installed under this work.
 - 3) Labeling/Color Coding of major termination assemblies (such as termination fields or frames, racks, etc.) installed under this work.
 - 4) Labeling the Telecommunications outlet housing individual connectors in the work area.
 - a) Labeling each connector terminating horizontal cables in these outlets.
 - b) Label identification within a given space (work area) shall begin at the entrance to the space and proceed in a clockwise manner around the space.
 - 5) Any additional components required by ANSI/TIA-606
 - c. All components of the commercial grounding and bonding system for Telecommunications; to include but not limited to all bonding conductors, PBB and SBB's.
 - d. All pathways (e.g., inner duct, cable racking, conduit, etc.) installed under this work.
 - 1) All interior pathways including cable trays and conduits shall be striped, traced, colored, or marked.
 - e. Provision of a database that records appropriate information regarding all cabling, terminations, frames, racks, etc. installed under this work.
 - f. In general, the label, plate or tag is to be provided and installed by whoever installed the item that is being labeled.

- g. Refer to individual Telecommunications specification sections (Division 27) and to the Telecommunications drawings for additional information on labeling requirements.

3.3 TEST REPORTS FOR THE STRUCTURED CABLING SYSTEM

A. General cable testing

1. Pre-installation testing:

- a. Visually inspect all cables, cable reels/boxes, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
- b. Where post-manufacturer test data has been provided by the manufacturer on the reel, box or shipping carton: submit copies to the Owner prior to installing cables.
- c. Mark reels or boxes as tested/inspected and submit associated test results to Owner/Design Consultant.
- d. Do not install any cable with less than the manufacturer's guaranteed number of serviceable conductors.

2. Post-installation testing:

- a. Calibrate all testers prior to use in accordance with manufacturers' printed instructions.
- b. Conduct cable testing as described below upon completion of installation. Test fully completed systems only. Piecemeal testing is not acceptable.
- c. Remove all defective cables from pathway systems. Do not abandon cables in place.

3. All test results and corrective procedures are to be documented and submitted to the Owner within five (5) working days of test completion.

- a. Prior to testing, submit for review and approval copies of test report forms proposed for use.
- b. Each test report shall contain the following general information: Date of Preparation, Date of Test, Project Name, Contractor's Name, Media Type, Make, Model and Serial Number of test equipment used, Date of Last Calibration and Names of Test Crew.

B. Copper cable testing

1. Perform all manufacturer recommended and required test calibration procedures prior to testing any cables.
2. Paired and multi-conductor riser metallic cables:
 - a. After terminating and splicing the cables. Test all cable pairs for continuity, ground fault, proper cross-connection, shorts and crossed pairs.
 - b. After installing cross-connects, perform end-to-end testing of each cross-connected cable pair for continuity, ground fault, proper cross-connection, shorts and crossed pairs.
 - c. Cable test reports: As a minimum, also provide: cable number, cable type, pair or conductor count, individual pair or conductor numbers, number of cross-connects and/or patches in each pair, results of each test for each pair or conductor, total number of serviceable pairs or conductors in cable.
3. Four-Pair Cables:
 - a. After terminating both ends of all 4-pair cables, but before any cross-connects are installed, test these cables for the following:
 - 1) Category 6 UTP
 - a) Wire map
 - b) Length
 - c) Insertion loss
 - d) Near-end crosstalk (NEXT) loss.
 - e) Power sum near-end crosstalk (PSNEXT)
 - f) Equal-level far-end crosstalk (ELFEXT)
 - g) Power sum equal-level far-end crosstalk (PSELFEXT)
 - h) Return loss
 - i) Propagation delay
 - j) Delay skew
 - 2) Augmented Category 6 F/UTP Cables
 - a) Wire map
 - b) Length

- c) Insertion loss
 - d) Near-end crosstalk (NEXT) loss.
 - e) Power sum near-end crosstalk (PSNEXT)
 - f) Equal-level far-end crosstalk (ELFEXT)
 - g) Power sum equal-level far-end crosstalk (PSELFEXT)
 - h) Return loss
 - i) Propagation delay
 - j) Delay skew
 - k) Alien Crosstalk (AXTalk) – Follow manufacturer's instructions for method
- 4. After installing cross-connects, perform end-to-end testing of each cross-connected cable for continuity, ground fault, proper cross-connection, shorts and crossed pairs. For 100 pair or smaller cables, replace entire cable if bad pair is found. For larger pair-count cables, replace if more than 1% of pairs are bad.
 - 5. Submit the following information regarding the cable testing: cable number, cable type, pair or conductor count, individual pair or conductor numbers, number of cross-connects and/or patches in each pair (if applicable), results of each test for each pair and total number of serviceable pairs in cable.
 - 6. In addition to the tests specified above, provide a minimum of two suitably qualified cabling technicians and copper test equipment to be present on-site for a period of 2 hours during the Design Consultant's Substantial Completion Review. Be prepared to conduct on-the-spot cable tests as requested. Successful equipment performance tests do not relieve the Contractor from the specified testing, repair, and documentation requirements.

C. Acceptance

- 1. The Owner and Design Consultant reserve the right to observe the conduct of any or all portions of the testing process.
 - a. The Owner and Design Consultant further reserves the right to request the Contractor conduct a random re-test of up to ten percent (10%) of the cable plant to confirm documented test results during the Substantial Completion Review. If more than 5% of these randomly tested cables do not pass, the Owner and Design Consultant reserves the right to require a re-testing of 100% of the cable plant, all without additional costs to the project.

2. For 100 pair or smaller replace entire cable if a bad pair or conductor is found. For larger pair count cables, replace if more than 1% of pairs are bad.
3. All test results are to be documented and submitted to the Architect in a timely manner, in accordance with the Submittal instructions in Part 1 of this section.
 - a. Corrective procedures following the Substantial Completion Review shall be properly documented, and affected and new cables shall be retested prior to Substantial Completion.
 - b. Updated complete Test Results, including retested, new and unaffected cables, shall be included in the Final Project Completion submittal.

3.4 SUBSTANTIAL COMPLETION REVIEW

- A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:
 1. The complete build-out of all Communications Rooms, cleaned of dust and debris.
 2. Installation, termination, final labeling, and testing of all backbone and horizontal cabling.
 3. The installation and labeling of all firestopping systems required for Telecommunications cabling and outlets. If firestopping was provided by a separate contractor (per Division 27 "Common Work Results for Communications"), ensure all firestopping systems are installed and labeled.
 4. The installation, labeling, and testing of the Telecommunications Grounding and Bonding System.
 5. Ensure faceplates are level, free of dust and paint, match color/style of adjacent electrical receptacle, and have blue protective film removed.
 6. Update jobsite Work Prints with all individual port / cable IDs, which shall correspond to the cable IDs in the Test Results.
 - a. These shall then be scanned to PDF (minimum resolution of 150 dpi) to be included in the Preliminary Project Completion documentation outlined in the Part 1 Submittal requirements earlier in this section.
- B. Request in writing a review for Substantial Completion. Refer to Part 1 Submittal requirements earlier in this section for required notice and Preliminary Project Completion documentation that shall be included with this request.
- C. State in the written request that the Contractor has complied with the requirements for Substantial Completion for the (Telecommunications) Structured Cabling System.
- D. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.

- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, then provide reimbursement to the Architect and Design Consultant for time and expenses incurred for the visit.
- F. Upon completion of the review, the Architect and Design Consultant will prepare a "final list" of outstanding items to be completed or corrected for final acceptance. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.

3.5 SPECIAL TOOLS

- A. Delivery to Owner's representative 2 complete sets (UON) of all special tools and small equipment items needed for proper operation, adjustment and maintenance of cabling and equipment installed under this work. All tools to be new and still in manufacturers packaging. The cost for these tools is to be included within the bid price for this work.
- B. The terms "special tools" and "small equipment items" is meant to include such items as punch down tools, connector assembly tools, etc. with each individual item having a retail replacement cost not exceeding five hundred dollars (\$500.00). It is NOT meant to include common hand tools such as standard screwdrivers, pliers, wrenches, etc.

END OF SECTION

SECTION 271100 - TELECOMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Section includes fittings that are within the physical walls of the communications equipment rooms to support the Telecommunications System. Fittings include but are not limited to:
 - 1. Bonding and Grounding (Earthing)
 - 2. Plywood Backboard
 - 3. Entrance Protection
 - 4. Racks
 - 5. Patch Panels
 - 6. Cable Management and Ladder Rack
- B. Section does not specify fittings such as cables, cable terminations, termination blocks, and patch panels for structured cable system (SCS). These components are specified in the Division 27 Section "Communications Backbone Cabling" and Division 27 Section "Communications Horizontal Cabling".
- C. Section does not specify fittings for audio video system(s). These components are specified in the Division 27 Section "Audio Video Systems".

1.2 RELATED SECTIONS INCLUDE THE FOLLOWING

- A. Follow all applicable codes, references, and standards listed in Division 27 Sections "General Communications Requirements" and "Structured Cabling System".
- B. Division 26 Section "Grounding and Bonding for Electrical Systems".

1.3 DEFINITIONS

- A. Backbone Bonding Conductor (BBC) – The conductor that interconnects elements of the telecommunications grounding infrastructure.
- B. Communications Equipment Room – This term shall apply to spaces specifically designed to maintain communications equipment. This definition shall encompass ANSI/TIA-569 terms for Entrance Room, Common Equipment Room (CER), and Common Telecommunications Room

(CTR). This definition also shall encompass BICSI Telecommunications Distribution Methods Manual terms for Telecommunications Room (TR), Telecommunications Enclosure (TE), Equipment Room (ER), and Entrance Facility (EF).

- C. Communications Entrance Protection – Fittings that reduce risk to life, limb, or property by protecting against power surges. This definition shall encompass protection devices and fittings described in Article 770 “Optical Fiber Cables and Raceways” and Article 800 “Communications Circuits” of NFPA 70 “National Electrical Code”.
- D. Communications Cabinet – A floor or wall mount unit enclosed with side panels. Communications equipment is supported by mounting rails separated at 19” or 23” inches.
- E. Communications Rack – A floor or wall mount unit without side panels. Racks can be 2-post or 4-post. Communications equipment is supported by mounting rails separated at 19” or 23” inches.
- F. Communications Frame - A floor or wall mount unit without side panels. Communications termination blocks are the only communications devices mounted to the unit.
- G. Communications Enclosure – A floor or wall mount unit enclosed with side panels. Communications equipment is not supported by mounting rails separated by 19” or 23” inches. This definition shall encompass BICSI Telecommunications Distribution Methods Manual term for Telecommunications Enclosure (TE).
- H. Ground or Grounding – A conducting connection, whether intentional or accidental, between an electrical circuit (e.g. telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.
- I. Primary Bonding Busbar (PBB) – A busbar placed in a convenient and accessible location and bonded by means of the bonding conductor for telecommunications, to the building service equipment (power) ground.
- J. Secondary Bonding Busbar (SBB) – A busbar placed in a convenient and accessible location and bonded by means of the bonding conductor for telecommunications, to the building service equipment (power) ground.
- K. Telecommunications Bonding Backbone (TBB) – A conductor that interconnects the Primary Bonding Busbar (PBB) to the Secondary Bonding Busbar (SBB).
- L. Telecommunications Bonding Conductor (TBC) – A conductor that interconnects the telecommunications bonding infrastructure to the building’s service equipment (power) ground.

1.4 SUBMITTALS

- ~~A.~~ Follow the requirements for submittals in Division 27 Sections “General Communications Requirements” and “Structured Cabling System”. ~~Also include the following:~~

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of device from a single manufacturer and through one source. Where practical and possible, obtain all devices from a single manufacturer and one source.
- B. Communications equipment room fittings shall be listed by a NRTL.

PART 2 - PARTS AND MATERIALS

2.1 BONDING AND GROUNDING (EARTHING)

A. General

- 1. Provide a complete functioning telecommunications grounding and bonding system, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary for the system to be in compliance with the ANSI/TIA-607 Standard "Generic Telecommunications Bonding and Grounding for Customer Premises". Major components include:
 - a. PBB in the Entrance Facility
 - b. TBC connecting the PBB to the main Electrical Service Ground.
 - c. All equipment and pathway grounding and bonding connections as identified on the drawings, recommended by manufacturers of equipment installed under this section, and stipulated in the referenced standard.
- 2. Available Component Manufacturers:
 - a. Chatsworth
 - b. Cooper B-Line
 - c. Erico
 - d. Harger
 - e. Hoffman
 - f. Panduit
- 3. Conductor Manufacturers
 - a. Shall be from the list of Component Manufacturers; or

- b. Shall be from the list of Manufacturers in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".

B. Primary Bonding Busbar (PBB)

1. Specifications

- a. All busbars shall have a clear cover installed to protect connections
- b. Cover shall be:
 - 1) Plexiglass or plastic
 - 2) Cover shall be printed with 3/8" lettering "PBB" using appropriate labels.
 - 3) Of the same manufacturer as the ground bar
- c. A predrilled Electrotin plated copper busbar provided with holes for use with standard sized lugs; hole patterns shall be in TIA/BICSI style.
- d. Have minimum dimensions of 1/4 inch thick x 4 inches wide x 20 inches long.
- e. Provide enough length for all connections with 25% growth.
- f. Provided with insulators to electrically isolate busbar from mounting surface.
- g. Provided with a minimum of 2-inches clearance from wall or other mounting surfaces for access.

2. Manufacturer shall be

- a. Harger TGBIP14420TMGB
- b. Chatsworth 40153-020
- c. Or equivalent from Component Manufacturer

C. Bonding Conductor (To main Electrical service ground) for Telecommunications (TBC): Insulated grounding wire with a minimum copper conductor size equal to that of the TBB, with PVC insulation. Shall be UL listed.

1. Specifications

- a. Shall be copper.
- b. Insulated grounding wire with PVC insulation
- c. A minimum copper conductor size equal to that of the largest TBB or other bonding conductor connected to the PBB, UON.

- d. Cable jacket marking: Shall be legible and shall contain the following information:
 - 1) Manufacturer's name
 - 2) Copper Conductor Gauge
 - 3) NRTL listing information
 - e. Cable jacket shall be green with black lettering
 - f. A minimum conductor size as indicated on drawings
- D. Ground Wire (for connections within each Telecommunications Room and to Cable Tray)
- 1. Specifications
 - a. Shall be copper.
 - b. When not routed through plenum or other air-handling space: Insulated grounding wire with a minimum copper conductor size of number 6 AWG, with PVC insulation. Shall be UL listed.
 - c. When routed through plenum or other air-handling space: Non-Insulated grounding wire with a minimum copper conductor size of number 6 AWG. Shall be UL listed.
 - d. Cable jacket marking: Shall be legible and shall contain the following information:
 - 1) Manufacturer's name.
 - 2) Copper Conductor Gauge.
 - 3) UL listing.
 - e. Cable jacket shall be green with black lettering.
- E. Connectors / Connections
- 1. Specifications
 - a. All connectors and connections shall utilize products that are Listed by a NRTL such as UL.
 - b. All connectors shall have twin clamping elements for cable; two holes for attachment to grounding bar, etc.
 - 2. Compression Lugs
 - a. Specifications

- 1) Shall be manufactured from electro-plated tinned copper for use with copper conductors.
 - 2) Shall include inspection port.
 - 3) On center dimension between holes (O.C. Dim. B/T Holes) shall be 0.625" ("A" Pattern) or 1" ("C" Pattern)
 - b. Manufacturer shall be:
 - 1) Harger GECLB Series
 - 2) Or Approved Equivalent
3. Conductor to conductor connection
 - a. Specifications
 - 1) All connections between conductor and the joining or mating of cables to connectors shall be done by exothermic weld or irreversible compression connector.
 - b. Manufacturer – Exothermic Weld
 - 1) Erico CADWELD
 - 2) Harger Ultraweld
 - 3) Or Approved Equivalent
 - c. Manufacturer – Irreversible Compression connector
 - 1) Burndy HYGROUND
 - 2) Or Approved Equivalent
4. Connector for conduit to cable
 - a. Specifications
 - 1) All continuous conduits (except entrance conduits) which extend into the Telecommunications Room shall be fitted with a pipe clamp or conduit bonding clamp connected to the PBB/SBB.
 - b. Manufacturer shall be:
 - 1) For 1" diameter and larger conduits – Harger series CPC electro tin-plated pipe clamp

- 2) For less than 1" diameter conduits – Harger TBGC4SCS electro tin-plated conduit bonding clamps
- 3) Or Approved Equivalent

F. Insulated Grounding Bushings

1. Specifications

- a. All communications entrance conduits that extend into the Telecommunications Room shall be fitted with an Insulated Grounding Bushing.
- b. Shall be UL Listed for copper conductors.
- c. Shall include lug for easy connection of conductor to PBB/SBB.

2. Manufacturer shall be:

- a. O-Z/Gedney IBC-L
- b. Or Approved Equivalent

2.2 PLYWOOD BACKBOARD

- A. 4' x 8' sheets of 3/4" thick (minimum) fire-retardant plywood shall be painted white with fire-retardant paint.

2.3 TELECOMMUNICATIONS ENTRANCE PROTECTION

A. Surge Protection

1. The following manufacturers are Conditionally Approved:
 - a. Circa Telecom
 - b. Emerson Network Power
 - c. ITWLinx
 - d. TII Network Technologies
 - e. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
2. Horizontal Cable Surge Protectors – for 4-pair, Category 6 horizontal cables that serve outlets exterior the footprint of the building, including, but not limited to, cables serving outlets that are mounted on roofs, exterior walls, light poles, and emergency phones/towers.

- a. Requirements
 - 1) Shall meet UL 497
 - 2) Shall exceed TIA 568 Category 6 performance standards
 - 3) Shall be capable of being used with POE+ applications
- b. Wall-mount Protectors – for single cables, where quantity of cables in Equipment Room needing protection is 6 or less
 - 1) Manufacturer shall be:
 - a) Emerson Edco CAT6-POE
 - b) ITWLinx SurgeGate Series CAT6-LAN
- c. Rack-mount Protectors – where more than 6 cables in an Equipment Room require surge protection
 - 1) Shall be rack-mountable in 19" wide equipment rack
 - 2) Provide quantity of Category 6 protectors/modules required for install, plus 25% spare
 - 3) Manufacturer shall be:
 - a) APC ProtectNet Chassis (PRM24) with Cat 6 Surge Modules (PNETR6)
 - b) Emerson Edco RM-CAT6-**POE
- d. Far-end Protection: Wherever connected devices (such as cameras) do not have integral protection, provide the following at the far-end of the cable:
 - 1) Blackbox CAT6 In-Line Surge Protector
 - 2) Emerson CAT6-5POE-FF

2.4 TELECOMMUNICATIONS RACKS

A. Two-Post Floor Rack

- 1. The following manufacturers are Conditionally Approved:
 - a. APC
 - b. B-Line
 - c. Chatsworth Products

- d. Great Lakes
- e. Hoffman
- f. Middle Atlantic
- g. Ortronics
- h. Panduit
- i. Or connectivity manufacturer carrying structured cabling warranty
- j. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

2. Requirements

- a. Approximately 7'-0" in height with 45U available to mount panels/equipment.
- b. Mounting rails shall be spaced 19" wide per ECA EIA/ECA-310-E. Mounting rails shall contain #12-24 tapped holes for patch panel applications. Mounting rails shall contain front and rear flange mounting holes for panels/equipment.
- c. Two-post rack shall be aluminum construction and have a self-supporting base.
- d. Finish shall be either clear grained aluminum powder coat in black. Provide touch-up paint matching powder coat.
- e. Minimum static load capacity: 1,000 lb
- f. UL Listed
- g. Secure rack to floor. Provide rack manufacturer's rack installation kit matching floor type of rack installation for a complete system meeting drawings and manufacturer instructions. Raised floor racks shall be mounted to sub or base floor with 5/8" threaded rods and steel brackets.
- h. Provide 6" stand-off bracket accessory on top of rack to mount ladder rack.
- i. Provide free standing relay rack accessories: rack base insulator kit, rack line-up spacer kit, rack base dust cover, equipment support bracket, equipment guard rail, and RMU Label Kit for a complete system meeting drawings and manufacturer instructions.

2.5 TELECOMMUNICATIONS PATCH PANELS

A. General

1. All telecommunications termination blocks and patch panels shall be by the same manufacturer and covered under the same Advanced Structured Cabling System Warranty.
 - a. Refer to Advanced System Warranty sub-section of Division 27 "Structured Cabling System" for list of approved connectivity manufacturers.
 - b. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

B. Rack-mount Modular - Copper Patch Panels

1. General Requirements for Patch Panels: Comply with referenced standards. Cables shall be terminated with connecting hardware of same category or higher.
2. Patch panels shall be provided complete with all mounting hardware, jacks, retainers, wire guides, designation strips, etc.
3. Patch panels shall accept modular jacks of exactly one port, and this modular jack shall be the same type as being installed at the far-end faceplates.
4. Provide enough ports for the number of cables terminated on the patch panel, plus 25 percent spare. Provide all connector blocks', including plugs and jacks where required to fill each panel completely. Do not leave any blank openings.
5. Modular Patch Panels shall be of a metal design with snap in module frames for each individual jack.
6. Ports and panels shall be easy to identify with label holders for machine-printed and color-coded labels. Rack mountable patch panels shall mount to standard EIA 19" racks.
7. Horizontal Cabling
 - a. Four-pair Augmented Category 6 and Category 6 UTP cabling shall be terminated onto a four-pair Augmented Category 6 and Category 6 jack module. All jack modules shall be terminated using the T568B wiring scheme. The eight-position jack module shall exceed the connector requirements of the TIA Augmented Category 6 and Category 6 standard.
8. Submit Manufacturer and part number as part of pre-construction submittals.

2.6 TELECOMMUNICATIONS PATCH CABLES & CROSS-CONNECT WIRES

A. General

1. Supply all necessary patch cables and cross-connect wires as part of a complete and functioning telecommunications system to support voice, data, audio-video, security, and other miscellaneous systems.
2. The manufacturer of patch cables shall be the same as the telecommunications connectivity, unless otherwise specified.

3. All patch cables shall be factory-terminated and tested.

B. Copper Patch Cords

1. Category performance shall be the same as copper patch panels.
2. Cable shall be 4-pair, twisted pair with factory-terminated RJ-45 modules on each end.
3. Provide (furnish and install) all patch cords required for the following connections and systems (coordinate color, length, and quantity with sub-contractors of those systems):
 - a. Fire Alarm Control Panels
 - b. Elevator Phones
 - c. Fax Machines
 - d. Emergency analog phone locations
 - e. LAN connections for Audio-Video Systems equipment
 - f. LAN connections Security Systems equipment and cameras
4. Furnish patch cords to the Owner prior to substantial completion in the following lengths and quantities:
 - a. Total quantity shall be 100% of the terminated ports, in the following colors and lengths:
 - 1) Data/Voice – Gray
 - 2) Wireless – Purple
 - 3) Security – Yellow
 - 4) IP Speakers – Black
 - 5) AV - Green
5. Manufacturer shall be:
 - a. Same as copper connectivity manufacturer
 - b. Submit product cutsheet for review

2.7 TELECOMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

A. Ladder Rack (Cable Runway)

1. Color: black
2. Rung Spacing: 9"
3. Width: 12"
4. UL Listed as an equipment grounding conductor
5. Provide ladder rack components such as e-bend, outside radius bend, and corner bracket for a complete system meeting drawings and manufacturer instructions.
6. Provide ladder rack supports such as wall angle support kit, triangular support bracket, center support kit, threaded rod, I-beam clamp, threaded ceiling kit, cabinet elevation kit, foot kit, rack mounting plate, rack elevation kit for a complete system meeting drawings and manufacturer instructions.
7. Provide ladder rack accessories such as cross member radius drop, end caps, and dividers for a complete system meeting drawings and manufacturer instructions.
8. The following manufacturers are Conditionally Approved:
 - a. B-Line
 - b. Chatsworth Products
 - c. nVent/Hoffman
 - d. Middle Atlantic
 - e. Or connectivity manufacturer carrying structured cabling warranty
 - f. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

B. Vertical Cable Managers

1. Manufacturer shall be the same as equipment racks and cabinets, unless otherwise noted.
2. Color: black
3. Size: as specified on drawings, or a minimum of 6" wide by 6" deep, whichever is greater.
4. The following manufacturers are Conditionally Approved:
 - a. B-Line
 - b. Chatsworth Products
 - c. Ortronics
 - d. Panduit

- e. Or connectivity manufacturer carrying structured cabling warranty
- f. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

C. Horizontal Cable Management

- 1. Manufacturer shall be the same as copper connectivity manufacturer.
- 2. Color: black
- 3. Size: 1RU or 2RU, as shown on the drawings.
- 4. The following manufacturers are Conditionally Approved:
 - a. Belden
 - b. Hubbell
 - c. Leviton
 - d. Ortronics
 - e. Panduit
 - f. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 GROUNDING AND BONDING INSTALLATION

- A. General:
 - 1. Install all other ground conductors (wire) without splices or mechanical couplers installed between the wire points of origin and termination except as shown on the Drawings and/or specified herein. Where splices are necessary, the number of splices should be a minimum and they shall be accessible and located in Telecommunications rooms (spaces). Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors, or equivalent. All joints shall be adequately supported and protected from damage. "Daisy chaining" of Telecommunications ground bus bars back to the PBB will not be accepted unless specifically indicated on the Telecommunications drawings or specified herein

2. Unless otherwise noted, all ground wires shall be routed through the Telecommunications cable management pathways so as to achieve a "coupled bonding conductor" effect
3. Where insulated conductors are necessary provide adequately rated insulation jackets or pathways to meet all required building codes. (I.e. Plenum, riser, outside plant, run entirely in conduit, etc.)
4. Grounding and bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet (1 meter) in length, the conductors shall be bonded to each end of the conduit using a grounding bushing or a No. 6 AWG conductor, minimum.
5. The Telecommunications Bonding Conductor (TBC), each Telecommunications bonding backbone (TBB) conductor, and each Backbone bonding conductor (BBC shall be green or marked with a distinctive green color
 - a. Marking with a distinctive green color Shall be done at a minimum of every 1 foot (0.3 meter) by appropriate methods
 - b. Indicate proposed and actual routing of these conductors on overall floor plans in both the pre-construction Shop Drawings and Record Drawings, respectively.
6. Follow additional installation requirements from NECA/BICSI 607-2011 "Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings".

B. Required Grounding Connections:

1. Provide and install one individual ground wire from each equipment rack/cabinet/frame (installed under this work) to the SBB in the room. Each conductor is to be "home run"; do not "daisy chain" the connections, except as may be indicated on the drawings.
2. Provide and install one individual ground wire from the raised floor system (if applicable) to the PBB. Conductor is to be "home run"; do not "daisy chain" the connections, except as may be indicated on the drawings.
3. Provide and install one individual ground wire from the overhead and vertical ladder racking (installed under this work) to the SBB in the room. All sections of ladder rack shall be securely connected together; otherwise, provide ground wire from each section of ladder rack.
4. Where structural steel is available for connection install one individual ground wire to the nearest structural steel for connection.
5. Provide and install all grounding connections as required by Telecommunications set of drawings.

C. Connector Installation:

1. Provide all ground wire connectors as shown on the Drawings or as indicated herein, unless otherwise noted.
2. Follow the connector manufacturer's instructions for installing the connector to the cable and the connector to the cabinet/rack, ground bar, etc. Use the appropriate tools for the job, tighten nuts/bolts to proper torque, remove paint, insulation, oxidation as needed to assure good metal to metal contact, etc. If the manufacturer does not provide tightening specifications, follow the recommendations of UL Standard 486.

D. Cable Identification:

1. Label both ends of each ground conductor within 6 inches (152.4 mm) of a connector terminal or splice. Label the grounding conductors as shown on the Drawings or specified herein. All labels shall include the following in addition to specific labeling requirements for each conductor.

**IF THIS CONNECTOR OR CABLE IS
LOOSE OR MUST BE REMOVED,
PLEASE CALL THE BUILDING
TELECOMMUNICATIONS
MANAGER**

E. Quantities of Ground Wires (Conductors)

1. Location and placement of grounding and bonding wires and components shall be as shown on the Drawings or defined herein.
2. Quantities of ground wires, bonding components, etc. shown on the drawings are illustrative only and are meant to indicate the general configuration of the work. Provide the correct quantities of materials to construct a grounding and bonding system that meets the intent of these Specifications and the relevant codes.

F. Sizing of Ground Wires (Conductors)

1. Subject to the applicable electrical code and the reference standards and guidelines, the TBC, TBB, BBC conductors (if applicable), and conductors to serving electrical panels and building steel shall be sized per the following table (Table 1 from ANSI/TIA-607):

Linear Length (ft)	AWG Size
less than 13	6
14-20	4
21-26	3
27-33	2
34-41	1
42-52	1/0

53-66	2/0
67-84	3/0
85-105	4/0
106-125	250 kcmil
126-150	300 kcmil
151-175	350 kcmil
176-250	500 kcmil
251-300	600 kcmil
Greater than 301	750 kcmil

G. Testing

1. As a minimum test, as described below, all metallic wires and cables installed under these Specifications.
2. Test the grounding conductor and the terminal connectors for total resistance between the equipment item being grounded and the main telecommunications grounding point in the room. This resistance Shall be less than 0.10 Ohm.
3. Recommended test equipment (obtain approval of Owner/ Design Consultant prior to using substitute test equipment):
 - a. An ohmmeter capable of indicating resistance down to 10 milli-ohms or below.

H. Acceptance

1. Upon receipt of the Contractor's documentation of cable testing, the Owner/ Design Consultant will review/observe the installation and randomly request tests of the cables/wires installed. Once the testing has been completed and the Owner/ Design Consultant is satisfied that all work is in accordance with the Contract Documents, the Owner will notify the Contractor in writing.

I. Record Drawings

1. The Project Record Drawings shall show the types and locations of installed grounding and bonding conductors.

3.3 TELECOMMUNICATIONS ENTRANCE PROTECTION INSTALLATION

- A. Fully protect each end of all incoming conductors which are considered to have lightning exposure in accordance with NEC chapter 8.
 1. Exception: Service providers will provide and install primary protectors on service entrance cabling.
- B. Install grounding wire as straight as possible from terminal to Grounding Bar.
- C. UON, mount all protection devices on wall surface in a manner sufficient to support the weight, and to sustain incidental contact.

D. Protector housings shall stack vertically.

E. Grounding and Bonding of Entrance Conduits

1. Bond all metallic shields and armored jacketing material for all incoming cables as close as practicable to the entry into the building.
2. Bonding conductors shall be connected to the appropriate bus bars as specified in this Section and in accordance with NEC chapter 8.
3. Connect the grounding conductor from the protection devices directly to the PBB/SBB as specified in this Section and in accordance with the NEC and the manufacturers' recommendations.
4. Verify grounding means exist at each end of the circuit as required by the NEC. If no grounding means exists then provide all connections required by the NEC.

3.4 TELECOMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES INSTALLATION

- A. Wall cabinets, racks, frames, and enclosures shall be installed on a plywood backboard or attached to a masonry wall. The rack should not be attached to sheet rock (gypsum wall board).
- B. Tags/labels shall be placed on each equipment rack, cabinet and frame in accordance with specification Division 27 Section "Common Work Results for Communications"

3.5 CABLE LADDER RACKING

- A. Installation and configuration shall conform to the requirements of the ANSI/TIA Standards 568C & 569, NFPA 70 (National Electrical Code), NEMA VE2, and applicable local codes.
- B. Install cable ladder racking level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- C. Install cable ladder racking where indicated in the drawings and as required by these Specifications
- D. Corner clamp brackets shall be used to join sections of cable ladder rack that are perpendicular to each other.
- E. Cable ladder rack stringers shall be attached to plywood backboards with angle brackets and "J" bolts.
- F. End supports and stringer junction brackets shall be used to attach vertical cable ladder segments to the floor.

- G. Stringer junction brackets shall be used to attach end to end horizontal cable ladder rack segments.
- H. Open ended stringer segments shall be closed with corner clamps and end bars.
- I. Mounting plates and "J" bolts shall be used to attach the cable ladder racking to the relay racks or equipment cabinets.
- J. Runway should be supported every 5 feet on center with 5/8 inch diameter threaded rod with slotted hanger clamps, or applicable support brackets or attachments, All wall brackets shall be attached to plywood backboard.
- K. A support shall also be placed within 24 in. on each side of any connection to a fitting.

3.6 CABLE MANAGEMENT AT EQUIPMENT RACKS AND CABINETS

- A. Install cable organizers and/or cable channel on equipment racks and within cabinets at locations as described in the Specifications and/or indicated on the Drawings.

3.7 QUANTITIES OF RACK/CABINET AND DISTRIBUTION FRAME EQUIPMENT AND COMPONENTS

- A. Location and placement of communications equipment room fittings shall be as shown on the Drawings or defined in these specifications and schedules.
- B. Quantities and sizes of communications equipment room fittings shown on the Drawings are illustrative only and are meant to indicate the general configuration of the work. Provide the correct quantities of all materials necessary to accommodate the work described in these specifications and schedules and shown on the Drawings.
- C. Equipment racks, cabinets and distribution frames shall be assembled and installed as per the manufacturers' printed instructions.

END OF SECTION

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Provide a complete Category 6 and 6A horizontal (work area) telecommunications cabling system as shown on the TN sheets and in accordance with these Contract Documents.
- B. This section specifies the following:
 - 1. Horizontal Copper Cable
 - 2. Copper Connectivity
 - a. Faceplates
 - b. Surface Box
 - c. Jacks/plugs/inserts

1.2 RELATED SECTIONS INCLUDE THE FOLLOWING

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions, requirements, and recommendations in Division 27 Section "General Communications Requirements"
- B. Refer to Division 27 Section "Common Work Results for Communications" for general pathway, firestopping, access panel, identification, and other requirements.
- C. Refer to Division 27 Section "Structured Cabling System" for Advanced System Warranty information and other requirements.
- D. Refer to Division 27 Section "Telecommunications Equipment Room Fittings" for telecommunications equipment racks, patch panels, wall-blocks, surge suppressors, and other equipment room requirements.
- E. Category 6 and fiber cabling and connectivity for Audio Video Systems (as required by the TA drawings) are specified in Division 27 Section "Telecommunications Requirements for Audio Video Systems".

1.3 CODES, STANDARDS, AND GUIDELINES

- A. In addition to all applicable codes, standards, and guidelines listed in Division 27 Sections "General Communications Requirements" and "Structured Cabling System", follow the most recent editions of the following:

1. NFPA 70 (NEC) – "National Electrical Code" (NEC)
2. IEEE NESC - "National Electrical Safety Code"
3. ANSI/BICSI 005 – "Electronic Safety and Security System Design and Implementation Best Practices"
4. ANSI/NECA/BICSI-607 – "Standard for Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings"
5. ANSI/TIA-568 – "Commercial Building Telecommunications Cabling Standard Set"
6. ANSI/TIA-569 – "Commercial Building Standard for Telecommunications Pathways and Spaces"
7. ANSI/TIA-607 – "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"
8. ANSI/TIA-606 – "Administration Standard for Commercial Telecommunications Infrastructure"
9. BICSI – "Telecommunications Distribution Methods Manual"
10. BICSI – "Information Technology Systems Installation Methods Manual"
11. IEEE 142 – "Recommended Practice for Grounding of Industrial and Commercial Power Systems" (Green Book)
12. IEEE 1100 – "Recommended Practice for Powering and Grounding Electronic Equipment" (Emerald Book)
1. TIA-526 – "Standard Test Procedures for Fiber Optic Systems"
13. TIA-TSB-140 – "Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems"

1.4 DEFINITIONS

- A. Advanced System Warranty – refer to Division 27 Section "Structured Cabling System".

- B. Communications Equipment Room - This CSI MasterFormat term shall apply to spaces specifically designed to maintain communications equipment. This definition shall encompass ANSI/TIA-569 terms for Entrance Room, Common Equipment Room (CER), and Common Telecommunications Room (CTR). This definition also shall encompass BICSI Telecommunications Distribution Methods Manual terms for Telecommunications Room (TR), Telecommunications Enclosure (TE), Equipment Room (ER), and Entrance Facility (EF).
- C. Direct Attach Method – as defined in ANSI/BICSI 005-2013, the horizontal cabling on the remote device end directly attaching (or connecting) to the device through a connectorized cable or hard-wired termination, eliminating the workstation outlet, jack and equipment cord.
- D. Horizontal Cabling
 - 1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - a. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector
 - b. Bridged taps and splices shall not be installed in the horizontal cabling
 - c. Splitters shall not be installed as part of the optical fiber cabling
 - 2. A work area is approximately 100 sqft, and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
 - 3. The maximum allowable horizontal cable length for Category copper cable is 295 feet (90 meter). This maximum allowable length does not include an allowance for the length of 16 feet (4.88 meter) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.88 meter) in the horizontal cross-connect.
 - 4. Horizontal cables longer than 295 feet shall be hybrid optical fiber and power conductor cable with a Power Over Ethernet Extender transmitter/receiver on each end.
- E. Structured Cabling / Telecommunications System – a fully-functional passive telecommunications system (infrastructure), that includes permanently installed copper Category and fiber optic cable terminated onto a patch panel or outlet.

1.5 QUALITY ASSURANCE

- A. As a minimum, the person(s) conducting the testing for all Telecommunications cabling shall be a current BICSI Certified Level II Commercial Installer or higher.

- B. All testing equipment used shall have the latest version of software and/or firmware installed prior to testing any cabling. Testing equipment shall also undergo all manufacturers' required and recommended routine maintenance.

1.6 SUBMITTALS

- A. Follow the requirements for submittals in Division 27 Section "General Communications Requirements"
- B. Pre-bid submittal
 - 1. For all products for which a substitute is to be considered as an approved equivalent or acceptable substitution provide submittals with sufficient detail for review by the Engineer. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information.
- C. Pre-construction submittal
 - 1. Provide a typed list indicating part name, manufacturer, part number, and color (if applicable) for products specifically identified herein by the exact and complete part number (no wild-card characters)
 - 2. Submit manufacturers' cut sheets or catalog cut sheets for:
 - a. Each of the cables specified. Cut sheets shall include the following information at a minimum:
 - 1) Manufacturers name and logo
 - 2) Cable outside diameter
 - 3) Number of conductors/strands in each cable and binder group
 - 4) Gauge or strand thickness
 - 5) Minimum transmission performance rating
 - 6) Cable jacket material and rating
 - 7) Maximum pulling tension
 - 8) Jacket/Sheath color
 - 9) Individual conductor or strand insulation colors

- 10) Minimum bend radius
 - a) During installation and post installation.
 - b) As well as any additional information required by individual sections of this Division.
 - b. Faceplates and modules. Cut sheets shall include the following information at a minimum:
 - 1) Manufacturers name and logo
 - 2) Material type
 - 3) Performance rating
 - 4) Physical Dimensions
 - 5) Color
 - c. Product information of test equipment to be used for the testing of cabling.
 - d. Provide documentation indicating manufacturer required and recommended maintenance and calibration services and intervals at which these services shall be performed.
 - 1) Provide documentation indicating the dates at which all testing units have undergone these services. For services required on a daily or pre-test basis provide documentation on the procedures the contractor will undergo for performing such services.
3. Shop Drawings
 - a. Submit for review scaled layout drawings showing the routing of all cabling, and the locations where terminal blocks, patch panels, Telecommunications outlets, cable types, cable jacket listing information, firestop locations (with quantity and NRTL system number identified), furniture feed points, and fiber optic termination panels are to be installed.
 - b. Shall show the number of horizontal cables served by each room and the number of patch panels and termination blocks to be installed (including those to accommodate 25% growth).
 - c. Each individual outlet on the drawings shall have proposed outlet identification indicated.

- d. Unless otherwise required by these specifications, it is permissible to show different cabling systems (voice, data, CATV, A/V) on the same shop drawing.
- 4. Testing
 - a. Qualifications: Identity and qualifications of the personnel who will perform the testing as required above in the Quality Assurance paragraph.
 - b. Submit all physical characteristics needed for appropriate testing setup and verification. I.e. Nominal velocity of propagation (NVP) for each and every cable type. This parameter shall be identified and submitted for review. Such submittals for all parameters shall be from printed manufacturers' cut-sheets or other manufacturers' printed material.
 - c. Submit the proposed schedule for performing testing at least 2 weeks prior to the start of testing.
- 5. Sample warranty information as indicated herein and elsewhere in this Division.

D. Project completion submittal

- 1. As-built Drawings
 - a. Submit scaled layout drawings showing the routing of all cabling, and the locations where terminal blocks, patch panels, Telecommunications outlets, cable types, cable jacket listing information, firestop locations (with quantity and NRTL system number identified), furniture feed points, and fiber optic termination panels have been installed.
 - b. Shall show the number of horizontal cables served by each room and the number of patch panels and termination blocks installed (including those to accommodate 25% growth).
 - c. Unless otherwise required by these specifications, it is permissible to show different cabling systems (voice, data, CATV, A/V) on the same As-built drawing.
- 2. After approval by the Owner, submit the test results in two computer readable copy in CD, DVD or mutually acceptable format by the Contractor and Owner.
- 3. Advanced Structured Cabling System Warranty Certificate

1.7 WARRANTIES

- A. Provide manufacturer warranties as required in Division 27 Section "Structured Cabling System".

PART 2 - PRODUCTS AND MATERIALS

2.1 HORIZONTAL (WORK AREA) COPPER CABLE

A. Horizontal cables for dry environments

1. Requirements

- a. Unshielded Twisted Pair (UTP)
- b. Minimum performance specifications: Cable shall meet requirements for ~~Category 5e~~ Category 6 and Augmented Category 6 for wireless access points of ANSI/TIA-568.
- c. Four pairs of 22-24 AWG solid copper conductors
- d. Cable jacket color(s) shall be
 - 1) Data and Telephone – Gray
 - 2) Wireless Access Points – Purple
 - 3) Video Surveillance Cameras – White
 - 4) IP Speakers – Black
 - 5) AV – Green
- e. Cable jacket marking: Shall be legible and shall contain the following information:
 - 1) Manufacturer's name
 - 2) Copper Conductor Gauge
 - 3) Pair Count
 - 4) UL and CSA listing
 - 5) Manufacturer's trade mark
 - 6) Category rating
 - 7) Sequential distance markings, in one foot increments
- f. Individually insulated conductors under a common sheath
- g. Plenum (CMP or MPP) rated.

2. Manufacturer shall be:
 - a. Belden Incorporated
 - b. CommScope Inc.
 - c. Corning Cable Systems (for Fiber portion only)
 - d. Hubbell
 - e. Legrand/Ortronics
 - f. Leviton
 - g. Panduit
 - h. Siemon
 - i. Superior Essex Cabling
 - j. Submit product data from Conditionally Approved manufacturer listed above (subject to Advanced System Warranty requirements)
- B. Horizontal cables for Wet Locations (as defined in Division 27 Section "Structured Cable System")
 1. Requirements
 - a. Suitable to be in contact with standing water
 - b. Cable construction shall be consistent with manufacturer's requirements to be covered under warranty specified in Division 27 Section "General Communications Requirements".
 - c. Minimum performance specifications: Cable shall meet requirements for Category 6 and Augmented Category 6 of ANSI/TIA-568.
 - d. Cable jacket marking: Shall be legible and shall contain the following information:
 - 1) Manufacturer's name
 - 2) Copper Conductor Gauge
 - 3) Pair Count
 - 4) UL and CSA listing

- 5) Manufacturer's trade mark
- 6) Category rating
- 7) Sequential distance markings, in one foot increments

2. Product shall be:

- a. Belden Incorporated
- b. CommScope Inc.
- c. Corning Cable Systems (for Fiber portion only)
- d. Hubbell
- e. Legrand/Ortronics
- f. Leviton
- g. Panduit
- h. Siemon
- i. Augmented Category 6 – Superior Essex BBDG6A
- j. Submit product data from Conditionally Approved manufacturer listed above (subject to Advanced System Warranty requirements)

2.2 FACEPLATES FOR COPPER CONNECTIVITY

A. Single-gang faceplate:

1. Requirements

- a. High impact nylonStainless Steel with number of ports to allow all modular jacks to be installed as required, and as indicated on the drawings.
- b. Color shall be match electrical, U.O.N. by owner
- c. Single gang, U.O.N

2. Submit Manufacturer and part number as part of the pre-construction submittals.

B. Weatherproof faceplate:

1. Requirements

- a. Water resistant faceplate (to IP56 rating, or equivalent) with number of ports to allow all jacks to be installed as required, and as indicated on the drawings.
 - b. With in-use cover
- 2. Product shall be:
 - a. Panduit Mini-Com Water Resistant Faceplate with integral cover.
 - b. Hubbell RW57300 (Or Approved Equivalent) with decora-insert and jacks from Conditionally Approved manufacturer listed above (subject to Advanced System Warranty requirements).

C. Surface mount box

- 1. Requirements
 - a. With number of ports to allow all jacks to be installed as required, and as indicated on the drawings.
 - b. Mount into backbox, U.O.N
- 2. Product shall be:
 - a. Submit product data from Conditionally Approved manufacturer listed above (subject to Advanced System Warranty requirements)

2.3 COPPER CONNECTIVITY

A. Modular jacks

- 1. Requirements
 - a. Outlets shall meet requirements for Category 6 and Augmented Category 6 of ANSI/TIA-568.
 - b. All 8-position modular jacks are to be wired according to the TIA T568A/B pin/pair assignments.
 - c. Outlet hardware shall be UL listed.
 - d. One port
- 2. Submit Manufacturer and part number as part of the pre-construction submittals.

B. Blank inserts

1. Requirements
 - a. Provide blank modules to fill any unused openings in faceplates
 - b. Color shall match other jack colors
2. Submit Manufacturer and part number as part of the pre-construction submittals.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 CABLE INSTALLATION

A. General

1. Place all horizontal cabling in accordance with these specifications, on the Drawings, and as indicated on any cable schedules
2. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications.
 - a. There shall be no splices or mechanical couplers installed between the cable points of origin and termination except as shown on the Drawings and/or specified herein.
 - b. There shall be no Bridged taps (multiple appearances of the same cable pairs at several distribution points) installed.
 - 1) Horizontal cabling shall be terminated in a Telecommunications room that is on the same floor as the area (outlet) being served in accordance with ANSI/TIA-568.
 - 2) No horizontal Category cables shall exceed the allowed maximum distance of 295 feet (90 meters) by ANSI/TIA-568.
 - 3) Horizontal cables longer than 295 feet shall be hybrid optical fiber and power conductor cable with a Power Over Ethernet Extender transmitter/receiver on each end.
3. Unless otherwise noted, all cables shall be routed through the building cable tray/conduit/surface-mounted raceway system. Refer to the electrical drawings for the layout of the conduits. Refer to the Telecommunications drawings for layout of cable tray.

- a. All horizontal cables shall be plenum (CMP, MPP) rated. UON
 - b. Horizontal cables installed in "wet" locations as defined by the NEC or in these construction documents (such as conduits embedded or routed below a ground floor slab) shall be suitable for installation in such environments and follow the installation requirements for outside plant cables as specified herein.
 4. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or any other method shall not be used to attach cables to cable supports or to create cable bundles.
 - a. Except when supported by ladder racking within each Telecommunications room, UON.
 5. At the same time horizontal cables are pulled into a conduit also install a pull cord to facilitate future cable pulls along those. Use polypropylene or monofilament plastic line with not less than 200 lb (90.72 kg) tensile strength. Leave at least 12 inches (304.8 mm) of slack at each end of pull cord.
 6. Do not install kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable
 7. Comply with all referenced standards and guidelines.
 8. Cables shall be masked, covered, or otherwise protected from being painted or coming in contact with any other substance that may degrade the performance or physical characteristics of the cable jacket or insulation over time.
 9. Where distance allows all horizontal cables shall be provided with slack/service loops at each end of the cable, one at the work area outlet and one at the Telecommunications room/enclosure. Each slack/service loop shall be:
 - a. A minimum of 8 feet in length, UNO
 - b. Configured in a loosely formed figure eight configuration (i.e. not coiled)
 10. Prior to using any cable pulling lubricants provide the Engineer with written documentation from the cable manufacturer supporting the cable manufacturers' acceptance of its use in compliance with all required warranties as part of these contract documents. The use of non-water based lubricants shall be provided when pulling PVC jacketed and all cables not suitable for contact with water.
- B. Outside plant cable installation: for cables placed in "wet locations" or as required by these construction documents. (I.e. all cables which extend beyond the footprint/envelope of the building or pathways leading to floor-boxes embedded in a ground floor slab)

1. Unlisted cables shall transition to an indoor rated cable within 50 feet of the entrance point as required the NEC.
 - a. This 50 feet allowed by code is only to allow termination as close as practicable to the entrance point. Terminate all outdoor only (unlisted) cables at the closest point of entrance and transition to an indoor rated cable to extend to additional Telecommunications rooms (spaces)
2. No portion of outdoor only (unlisted) cables may be installed with the cable jacket exposed in any plenum or other air handling space nor shall they be allowed to transition between different levels of the building.
3. Where specifically allowed by these construction documents cable jackets rated for dual use by a NRTL, such as an indoor/outdoor rated cable may be used.
 - a. These cables may be installed in locations within the building in which the cable jacket is appropriately rated to meet all applicable building codes.
4. Rigid metallic conduit shall be used to route outdoor (unlisted) cabling to within 50 feet (15.24 meter) of the transition point to indoor rated cabling in accordance with the NEC.
5. All cables which extend beyond the envelope/footprint of the building shall be installed with entrance protectors in accordance with Division 27 Section "Communications Equipment Room Fittings"

C. Horizontal (work area) Cables:

1. From the appropriate Telecommunications room, provide each work area outlet, the types and quantities of horizontal cables as described in the applicable system specification sections. Cables will leave the Telecommunications room via cable tray, conduit/sleeve or floor duct. Each cable will be terminated except for pay phone and elevator machine room junction box locations.
2. Install all horizontal cables in accordance with Division 27 Section "Common Work Results for Communications" and as indicated on the drawings.

3.3 CABLE & WIRE INSTALLATION

A. General:

1. Place all station cabling in accordance with these specifications, and as indicated on the cable schedules and the Drawings.

B. Cables located in "wet" locations

1. Provide all required entrance protection in accordance with Division 27 "Communications Equipment Room Fittings".
2. Follow the requirements for installing outside plant rated cable as specified in Division 27 Section "Communications Horizontal Cabling"
3. All cables routed to floor boxes in the slab shall route to a transition box within 50 feet (15.24 meter) of where the conduit emerges from the slab. Provide connecting hardware within an appropriately rated enclosure to allow a transition from outside plant cable to indoor rated cable. Indoor rated cable shall be rated as required by building code and as specified herein. Route indoor cables as indicated for horizontal cable distribution. Transition hardware shall meet or exceed the category performance of the highest rated cable being terminated.
 - a. Cables from multiple different floor boxes may be routed to a single, appropriately sized, transition enclosure.

C. Elevator Phone Cables:

1. Install elevator phone cables to support communications to each individual elevator cab. These cables will be run from each elevator's respective elevator equipment room to the nearest Telecommunications room as shown on the Drawings. Leave 15 feet of coiled slack in the elevator equipment room junction box for eventual termination by the elevator contractor.

3.4 CONNECTOR INSTALLATION

- A. Furnish and install all cable connectors as shown on the Drawings.
- B. Provide number of connectors as required by the Drawings and as required by these documents, where the number of connectors required does not fill the entire faceplate provide blank inserts so that no opening is left.
- C. The provision and termination of connectors from each cable shall be done as follows:
 1. Where connector types are identified on the applicable drawings or in the specifications, furnish and install the specified connectors on the specified cables. Installation of the connectors shall be in accordance with the manufacturer's printed instructions.
 2. All installed connectors, regardless of type, method of procurement or permanency, shall be adequately protected during and after installation.
- D. Copper Connector Installation
 1. Terminate all four pairs of each cable on one outlet jack.

2. Furnish and install all cable connectors as shown on the Drawings or as indicated herein, unless otherwise noted.
3. The provision and termination of connectors for each cable shall be done as follows:
 - a. Where connector types are identified on the applicable drawings or in the specifications, Furnish and install the specified connectors on the specified cables. Installation of the connectors shall be in accordance with the manufacturer's printed instructions.
 - b. All installed connectors, regardless of type, method of procurement or permanency, shall be adequately protected during and after installation.

3.5 FLOORBOX LOCATIONS

- A. Refer to Division 27 "Common Work Results for Communications" for size, type, and specifications.
 1. Provide appropriate mounting brackets (as required), faceplates, modular jacks, inserts, mounting frames and cabling required to fully populate and provide a fully functional system.
- B. For slab-on-grade floorbox locations, coordinate with the Common Work contractor to extend underground or in-slab conduit all of the way to the serving Telecommunications Room. If that is not practical, coordinate with Common Work contractor on stub-up location and overhead enclosure size/location to transition OSP (wet-rated) cable to plenum-rated cable.
 1. Note underground conduit routing and overhead transition point locations on pre-construction shop drawings and Record Drawings.

3.6 FACEPLATE INSTALLATION

- A. Furnish and install all faceplates in locations as shown on the Drawings.

3.7 CABLE IDENTIFICATION

- A. Label all horizontal cabling with machine-printed labels according to the labeling scheme identified on the drawings. Where the drawings are silent, submit RFI through appropriate channels requesting labeling scheme.
 1. Shop drawings shall include floor plan that indicates proposed cable/outlet identification for each outlet.
- B. Cables shall be labeled within 6" at each end.

- C. All cable labels shall be thermal-transfer type and utilize self-adhesive labels. The following are approved manufacturers:

- 1. Brady, IDXPRT
- 2. Hellermann Tyton, Spirit 2100
- 3. Panduit LS9
- 4. Or equivalent

3.8 CABLE TERMINATIONS

- A. Terminate all horizontal cables in accordance with Division 27 Section "Communications Equipment Room Fittings". No cables shall contain unterminated elements UON.

3.9 CABLE TESTING

- A. Refer to Division 27 Section "Structured Cabling System" for testing requirements.

3.10 ACCEPTANCE

- A. The Owner and Design Consultant reserves the right to observe the conduct of any or all portions of the testing process.
- B. All cables that fail testing are to be corrected prior to substantial completion and acceptance by owner. Replace entire cable if bad pair or conductor is found.

END OF SECTION

SECTION 274100 - AUDIO VIDEO SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. These specifications and the associated TA series drawings describe the audio-video (AV) systems (hereafter referred to as the "Technical System") requirements to be furnished and installed as a portion of the project scope of work.
- B. System is intended for localized television.
- C. Work includes all such work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Communications, Fire Alarm and Electronic Safety and Security Drawings and Specifications; and Addenda.
- D. Work under this section of the specifications includes all labor, equipment, and installation as required to provide a complete technical system in compliance with the contract documents.
- E. Employ the services of a qualified structural engineer to review all overhead mounting and suspension details of the technical system equipment. All mounting and suspension schemes indicated on the drawings are shown for concept only. Submit shop drawings stamped by a structural engineer of all details and weights for review by the project's Architect, Structural Engineer, and Design Consultant.
- F. The work in this section shall be coordinated with other work to determine installation scope for conduit, outlet boxes, junction boxes, pull boxes, terminal cabinets, 120-volt AC power circuits, and insulated ground cables required for the technical system.
 - 1. Provide related low-voltage "on/off" AC power control system wiring, low-voltage "on/off" control switches, and certain AC power/ground requirements internal to the equipment racks as specifically noted herein and/or on the drawings.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section, as do the following:
 - 1. Division 27 Section "General Communications Requirements"
 - 2. Division 27 Section "Common Work Results for Communications"
- B. All Category and fiber optic cabling and terminations shall adhere to the Division 27 Section "Telecommunications Requirements for Audio Video Systems".

- C. This section is a parent section to all sections numbered 274101 thru 274199. Requirements found in this section shall apply to all child sections unless otherwise noted.

- 1. Exception: Division 27 "Television Distribution Systems" is a stand-alone section.

1.3 EXAMINATION OF SITE

- A. This project is a new facility.
- B. Prior to submitting a bid personally examine the site of the proposed work and verify the conditions which involve this work.
- C. By the act of submitting a bid, the contractor will be deemed to have made reasonable allowances for site examinations, site conditions, and included all costs in his proposal. Failure to verify these conditions will not be considered a basis for the granting of additional compensation.

1.4 MATERIAL AND WORKMANSHIP

- A. All equipment shall be new and in proper operating condition. All workmanship shall be of the finest quality by experienced installation technicians.
- B. Contact the Architect, in writing, regarding the selection of colors for all exposed equipment.
- C. In addition to a complete set of the system project drawings and specifications, maintain at the job site a complete set of manufacturer's original operation, instruction, installation, and service manuals for each equipment item, for reference.

1.5 ORDINANCE AND CODES

- A. Comply with all applicable national and local codes and ordinances and obtain all required permits.
- B. Contractor shall be responsible for any and all violations within the scope of this work.

1.6 DEFINITIONS

- A. Structured Cabling System – the physical infrastructure installed to support information technology/transport for voice and data applications, commonly referred to as a Telecommunications System. This includes, but is not limited to: Category cabling, terminations/blocks, modules, faceplates, etc., and optical fiber cabling, terminations, modules, etc.
- B. Suspension System – A unique assembly of rated hardware elements and accessories required for overhead installation (and attachment to building structure) of loudspeakers and other technical

system components. Elements of a suspension system may include: wire rope, shackles, eyebolts, chain, beam clamps, strut channel, etc.

1.7 QUALITY ASSURANCE

A. Contractor General Qualifications:

1. Compliance with the requirements of Division 1.
2. Licensed to perform work of this type in the project jurisdiction.
3. At least five (5) years of verifiable direct experience with the devices, equipment and systems of the type and scope specified herein.
4. Prior successful experience of projects of similar size, scope and type as outlined in the Construction Documents.
5. Active membership in the National Systems Contractors Association (NSCA).
6. Active membership in The Audiovisual and Integrated Experience Association (AVIXA).
 - a. AVIXA APEX certification.
7. Fully staffed and equipped maintenance and repair facility.
8. Factory-authorized dealer for the major components specified.

B. Contractor Personnel Qualifications:

1. Skilled workers thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and the methods needed for proper performance of the work in this section. The workers shall have at least three (3) years direct experience in similar work, evidence of which shall be verified in writing with appropriate references.
2. Supervisor with at least five (5) years direct experience in similar work. The supervisor shall be present for and in responsible charge of all work in the fabrication shop and on the project site during all phases of the installation and testing of the system(s). To assure continuity, this supervisor shall be the same individual throughout the execution of the work unless illness, loss of personnel, or other reasonable circumstances intervene. This person shall act as the Technical System Project manager and shall attend all scheduled project meetings.
 - a. Minimum of one full-time staff member who has attended technical system design and installation courses taught by Syn-Aud-Con in the past 10 years.
 - b. Minimum of one AVIXA CTS-I (Certified Technology Specialist - Installation) systems technician.
 - c. Minimum of one full-time staff member who has a minimum of three (3) years direct experience with and is factory-certified on the most recent version of the selected Digital Signal Processor (DSP) software and technology. This individual shall be responsible for the implementation of the DSP system including software. This individual shall be the same throughout the execution of the work unless illness, loss of personnel, or other reasonable circumstances intervene.
 - d. Minimum of one full-time staff member who has a minimum of three (3) years direct experience with network-based AV transport and is factory-certified on the most

recent version of the selected AV transport technology. The individual shall hold a current manufacturer's certification (i.e., Crestron DMC-E). This individual shall be responsible for the implementation and preliminary testing of the AV transport system. This individual shall be the same throughout the execution of the work unless illness, loss of personnel, or other reasonable circumstances intervene.

- e. Minimum of one full-time staff member who has a minimum of three (3) years direct experience and is a factory certified Master Level Programmer on the most recent version of the AV control system software and technology. This individual shall be the same throughout the execution of the work unless illness or loss of personnel intervenes. A factory authorized independent programmer (i.e., Crestron Master CAIP) will also be accepted, providing the programmer meets the criteria identified in this paragraph.
- C. Provide additional information as required for review by the Owner's Representative, Architect, and Design Consultant to aid in proving acceptability.

1.8 SUBMITTALS

- A. Refer to requirements in Division 27 Section "General Communications Requirements".
- B. Include the following items specifically as it relates to AV:
 - 1. Submittal #1: AV System Product Data (Pre-Construction). A separate product data submittal is required for each specification section, i.e., 274100, 274116, etc.
 - a. Equipment List (1A)
 - b. Manufacturers' cut sheets (1B)
 - c. Product Substitutions (1C)
 - d. Project Implementation Schedule (1D)
 - 2. Submittal #2: AV System Shop Drawings (Pre-Construction)
 - a. AV Pathways, Devices, and Cabling (2A) – Follow requirements of Division 27 Section "Common Work Results for Communications". Indicate locations of all devices and equipment.
 - b. Signal Flow Shop Drawings (2B) – Any generic diagrams found within the Construction Documents shall be drawn to specific requirements. Alterations from basis of design found within the Construction Documents shall be reflected and identified. Include wire numbering scheme.
 - c. AV Control System (2C) - AV control system panel/screen layouts suitable for the Owner's Representative to understand the operation and flow (submitted no less than five months prior to system first use).
 - d. DSP Signal Flow (2D) - DSP signal flow configuration (submitted no less than three months prior to system first use).
 - 3. Submittal #3: AV System Fabrication Drawings (Pre-Construction)

a. Structural Details (3A)

- 1) No Suspended device shall be installed prior to the final approval of Structural Detail Submittals by the Consultant.
- 2) For Suspended equipment provide detailed, dimensioned drawings of each Suspension hardware assembly. Also indicate location relative to structure, location relative to other component(s) (Technical System or otherwise), configuration of suspended components, attachment to structure, suspension method, and calculations.

a) Calculations shall include weights of Technical System equipment including suspension hardware, and details of all suspension hardware including: manufacturer(s), part number(s) and pertinent technical information (i.e., Working Load Limit) of each part including nuts, bolts, and other accessories. All weight bearing hardware must be traceable, load rated, and domestically manufactured. All welds must be certified.

- 3) Prior to submission, these drawings must be approved and signed/sealed by a structural engineer licensed for the location of the project. The following guidelines are applicable:

a) Contractors participating in the Suspension of Technical System components shall conform to industry best practice standards as set forth in:

- i) "Basic Principles for Suspending Loudspeaker Systems" (JBL Professional Technical Note Volume 1, Number 14); and
- ii) ANSI E1.4-2 – 2021 (Entertainment Technology – Statically Suspended Rigging Systems); and
- iii) ANSI E1.6-2 – 2020 (Entertainment Technology – Design, Inspection, and Maintenance of Electric Chain Hoists for the Entertainment Industry); and
- iv) ANSI E1.6-3 – 2019 (Selection and Use of Serially Manufactured Chain Hoists in the Entertainment Industry).

b) All Suspended loudspeakers shall conform to ANSI E1.8-2018 (Entertainment Technology—Loudspeaker Enclosures Intended for Overhead Suspension—Classification, Manufacture and Structural Testing).

- b. Equipment Rack Shop Drawings (3B) - Equipment rack front elevation for each rack showing equipment, panel layout, and electrical circuiting.
- c. Panel, Patch Panel, and Plate Shop Drawings (3C) - All panel, patch panel, and plate layouts indicating locations of connectors, engraving, nomenclature, panel material, and finish. Include Structured Cabling Work required by the technical system.
- d. Millwork Shop Drawings (3D) - Sound console and mobile cart millwork details, and related equipment and panel layout (submitted no less than three months prior to the installation of other millwork).

- a. Video Wall Shop Drawings (3E) – Dimensioned elevations (front and side) for each video wall showing panel layout, ancillary equipment at wall location, low voltage/signal circuiting, and electrical circuiting.
4. Submittal #4: AV System Test Results (Prior to Substantial Completion)
 - a. Preliminary Testing Documentation Package (4A) – Provide preliminary results of system testing as described in Part 3 of this section for review prior to final acceptance. Include final results with Closeout Documentation.
5. Project Closeout
 - a. Refer to Division 27 Section “General Communications Requirements” and the Record Drawings and Operation and Maintenance Data sub-sections in Part 3 of this section for requirements.
6. Refer to child sections for additional requirements.

1.9 SUBSTITUTIONS

- A. Refer to Division 27 Section “General Communications Requirements”.

1.10 ELECTRONIC FILE SHARING

- A. Refer to Division 27 Section “General Communications Requirements” for information on obtaining electronic versions of the construction drawings.

1.11 PROTECTION OF WORK

- A. Protect all work, materials, and equipment from damage due to any cause. Provide for the safety and new condition of the equipment and materials until final acceptance by the Owner's Representative. Replace all damaged or defective materials and/or equipment as directed by the Architect or Design Consultant.
- B. Equipment racks, cabling racks, junction boxes, termination boxes, and other exposed equipment shall be kept covered and protected from airborne contaminants. Clean all debris from the equipment room(s)/location(s) and control areas, and clean all equipment and the interior rack floor, prior to system final acceptance activities.

1.12 OWNER FURNISHED EQUIPMENT

- A. Certain technical system equipment shall be Owner furnished for use with the new technical system as indicated on the drawings and in these specifications. Provide any equipment not specifically noted as Owner Furnished Equipment (OFE).

- B. Obtain this equipment from the Owner's Representative in a timely manner as required to coordinate with the project schedule. Verify all model numbers, quantities, sizes, and connector types as necessary to coordinate with system requirements. The Owner's Representative may elect to substitute other equipment in lieu of that listed prior to the submission of shop drawings.
- C. Examine the equipment and perform normal operational checks to verify that the equipment is in good condition and is operating normally. Should any equipment defects be found (physical, electrical, or otherwise), identify, in writing to the Owner's Representative: a) defects found; and b) the estimated cost of any proposed repairs versus cost of replacement.
- D. Fully integrate the equipment with the technical system and provide all necessary signal connections and programming.
- E. Proper operation and maintenance of such equipment remains the responsibility of the Owner's Representative.
- F. Other Owner-furnished equipment may be used by the Owner's Representative with the new technical systems. Proper operation and maintenance of the equipment remains the responsibility of the Owner's Representative.

1.13 TEMPORARY TECHNICAL SYSTEM

- A. Provide and operate a temporary technical system of reasonably equivalent function as determined by the Design Consultant if the work in this section, as a failure of the contractor, is incomplete or found not in conformance with the contract documents. The temporary system shall remain in use until acceptance of the permanent system.

1.14 WARRANTY

- A. Warrant all work executed under this contract, including all in-shop and onsite material, parts, and labor, for a period of twelve months after the date of final acceptance.
 - 1. Existing or any other Owner-furnished equipment shall not be included in this warranty.
 - 2. For equipment that has an advertised manufacturer's warranty longer than 12 months, include end date of warranty period.
- B. The warranty services are limited to normal business hours unless additional agreements are made between the Owner's Representative and the contractor.
- C. Warranty work relating to technically complex equipment and/or programming such as for codecs, digital signal processing, control systems, and video projectors shall be performed by a factory authorized technician.
- D. Damage to the system resultant from improper use or adjustment by others, negligence, acts of nature, or other causes which are beyond the contractor's control shall be excluded from the warranty.

- E. Visit the job two weeks prior to the end of the warranty period to check all equipment for proper system operation. Any defective equipment found shall be replaced or repaired under the terms of the system warranty.
- F. Update Record Drawings and Operation and Maintenance Data to reflect work done during Warranty period and provide the updates to the Owner's Representative and Design Consultant.
- G. Refer to General Conditions for additional requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise designated, provide all of one type of equipment from one manufacturer. For example, microphones of one type by one manufacturer, data switches of one type by one manufacturer, cabling of one type by one manufacturer, or loudspeakers of one type by one manufacturer.
- B. Equipment and wiring shown on the drawings represents the basis of design. Ensure similar or better performance is achieved by substituted equipment.
- C. All major components of technical system equipment shall be provided and installed by a qualified contractor as outlined in Part 1 of this section.
- D. All equipment shall be new and of professional quality.

2.2 CONNECTORS

- A. The products in this section have been approved for use in the project as necessary to facilitate a complete and working system. Inclusion in this section does not indicate a requirement for use.
- B. All XLR receptacles located outdoors, in boxes that are located outdoors, in natatoriums, or in areas where moisture or other corrosive materials are present shall have gold plated contact pins.
- C. XLR Cable Connector, cable mounted connector for line-level, microphone level, and intercom circuits:
 - 1. Amphenol AC series; or
 - 2. Neutrik X-series; or
 - 3. Switchcraft E Series Q-G.
- D. XLR Panel Connector, panel mounted audio connector for line-level, microphone level, and intercom circuits, color shall match plate color where possible:
 - 1. Amphenol AC "DZ" series; or

2. Neutrik D-Series; or
 3. Switchcraft standard AAA Series Q-G with metal handle.
- E. XLR Combo Connector, female XLR and 1/4" TRS receptacle in one chassis-mount connector:
1. Neutrik NCJ6FI-S.
- F. 1/4" TRS Cable Connector, three-conductor (Tip Ring Sleeve) connector with a metal barrel and solder lugs:
1. Amphenol TS3PN; or
 2. Canare F-16; or
 3. Neutrik NP3C; or
 4. Switchcraft 267.
- G. 1/4" TS Cable Connector, two-conductor (Tip Sleeve) connector with a metal barrel and solder lugs:
1. Amphenol TM2PN; or
 2. Canare F-15 plug; or
 3. Neutrik NP2C plugs; or
 4. Switchcraft 250.
- H. 1/4" TRS Panel Connector, three-conductor (Tip Ring Sleeve) connector with the sleeve contact isolated from the panel or plate to which it is mounted:
1. Neutrik NJ3FP6C; or
 2. Switchcraft E112BL.
- I. 1/8" TRS Cable Connector, 1/8" (3.5mm) three-conductor mini-plugs which have a metal barrel and solder lugs:
1. Amphenol KS3P; or
 2. Canare F-12; or
 3. Neutrik NTP3RC; or
 4. Switchcraft 35HDNN plug.
- J. Locking LS Cable Connector, twist-lock cable mount male loudspeaker connector, minimum 2-two conductors. Coordinate connector with associated intended panel mount connector, including those on loudspeakers:
1. Amphenol SP-2-FN (two conductor); or
 2. Neutrik speakON NL2FC (two conductor); or
 3. Amphenol SP-4-FN (four conductor); or
 4. Neutrik speakON NL4FC (four conductor); or
 5. Neutrik speakON NL8FC (eight conductor).

- K. Locking LS Panel Receptacle, twist-lock chassis mount female loudspeaker connector, minimum two conductors. Coordinate receptacle with associated intended cable connector:
 - 1. Amphenol SP-2-MD (two conductor); or
 - 2. Neutrik speakON NL2MP (two conductor); or
 - 3. Amphenol SP-4-MD (four conductor); or
 - 4. Neutrik speakON NL4MP. Male connector (four conductor); or
 - 5. Neutrik speakON NL8MPR-BAG (eight conductor)
- L. RJ45 Panel (Faceplate) Connector-6, data connector rated for shielded Category 6 cable:
 - 1. Neutrik etherCON NE8FDY-C6* with SCDX cover
*Division 27 "Telecommunications Requirements for Audio Video Systems" Contractor shall terminate cable onto etherCON connector installed in custom faceplate.
- M. BNC Cable Connector, 75-ohm BNC, compression fitting for coaxial cable furnished:
 - 1. Liberty CM-RG-BNC series; or
 - 2. West Penn CN-CS-BNC and CN-FS-BNC series.
- N. BNC Panel Connector, 75-ohm BNC, pass-through, D-style mounting:
 - 1. Neutrik NBB75DFI; or
 - 2. Approved Equal.
- O. Terminator, RF or SDI terminator plug:
 - 1. Extron T-BNC series; or
 - 2. Pomona 3840 series; or
 - 3. Trompeter TNA series.
- P. Terminal Block Terminations
 - 1. Utilize as applicable and only as allowed per Part 3.
 - 2. Acceptable mounting methods include:
 - a. For small quantities in AV Closets: Mount DIN rail within rear of AV equipment rack. Utilize as preferred method wherever feasible and provide a compatible DIN rail rack mount kit.
 - b. For large quantities in AV Closets: Mount DIN rail(s) to plywood backing on wall. Utilize wall mounting DIN rail brackets.
 - 1) Microphone level cable shall be mounted within an enclosure.
 - c. For field locations: Provide a minimum NEMA 1 rated enclosure and locate DIN rail(s) within enclosure. Ensure enclosure is properly labeled and identified on as-builts.

3. Captive Screw Terminal Block: modular terminal blocks for mounting on DIN rails:
 - a. Entrelec (TE) Screw Clamp series; or
 - b. Legrand Viking 3 series; or
 - c. Approved equal.
4. Terminal Block DIN Mounting Rails: DIN rails for mounting of terminal blocks:
 - a. Crestron DIN-EN series; or
 - b. Hoffman DIN Rail LMK series; or
 - c. Middle Atlantic FWD-DIN1H; or
 - d. Approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions.

3.2 PREPARATION

- A. Coordinate locations and sizes of junction boxes, outlets, and conduit with the work of other trades. Field verify compliance with the construction documents.
- B. Carefully inspect areas where equipment will be installed. Notify the Architect of any conditions that would adversely affect the installation and subsequent operation of the system.
 1. Repeat inspection on a regular basis to ensure ongoing work by other trades does not pose a conflict to Contractor's pending work.

3.3 INSTALLATION

- A. General
 1. Contractor shall demonstrate a reasonable standard of care. Installation shall be rendered in a workmanlike manner observing direction set forth herein as well as industry standard best practices.
 2. In addition to any spare cabling shown on drawings, utilize industry best practice to pull additional spare cabling in conduit where logical. Neatly bundle a usable length of cable at each end of each spare circuit. All spare circuits shall be labeled and noted on the field drawings for inclusion into the record drawings.
 3. Install any floor-mounted receptacles so that release buttons (for both receptacles and cable connectors) are easily accessible when cable connectors are installed.

4. Blank panels and/or vent panels shall be installed in unused rack spaces. Ensure that air flow within the rack is maintained (i.e., cool air can enter the rack and hot air can exit the rack).
5. Equipment racks and other exposed equipment shall be kept covered and protected from airborne contaminants. Clean all equipment racks and the interior rack floor, prior to system final acceptance activities.
6. Where the design location requires products, materials, or equipment to be visible to the public, manufacturers logos shall be removed if possible. Unless otherwise directed, neatly remove logos.
7. AC power switches located on the front panel of equipment mounted in racks shall be covered by a security cover or utilize front panel lockout features. Exclusions from this list are items requiring user interface such as tuners and wireless microphone receivers.
8. Furnish all equipment with factory finish where possible using the standard available factory color(s) as selected by the Architect. Notify the Architect regarding color options of relevant equipment prior to ordering equipment from each manufacturer.

B. Suspended Systems

1. General

- a. Contractor shall provide Suspension system, including connection to structure, for all suspended components including but not limited to: loudspeakers, video projectors, flat panel displays, televisions, projection screens, etc.
- b. Suspension system design shall be created by the Contractor and include fully dimensioned detail documentation stamped by a structural engineer licensed in the location of the project per submittal requirements in Part 1 of this document.
- c. Contractor shall include a safety cable or other backup support mechanism.
- d. Suspension systems and installation shall conform to industry best practice standards as set forth in:
 - 1) "Basic Principles for Suspending Loudspeaker Systems" (JBL Professional Technical Note Volume 1, Number 14)
- e. Coordinate with General Contractor any supplemental building structure necessary to facilitate the approved suspension design.
- f. Field verify conditions for compliance with the approved suspension plan prior to installation, placement of equipment orders, or material fabrication. Coordinate with other trades as necessary.

2. Loudspeakers

- a. Install loudspeakers so there are no obstructions to loudspeakers' coverage pattern.
- b. Loudspeakers shall be installed such that they do not produce or cause mechanical rattles in the surrounding structure. There shall be no audible vibration or noise caused by improper mechanical installation or defective components.
- c. Paint loudspeaker and/or grille assembly (at discretion of Architect or Design Consultant) color as selected by the Architect. Use primer per manufacturer's

recommendations. Do not paint loudspeaker cones or high frequency diaphragms. Materials and labor provided by Contractor.

- d. Provide access to loudspeakers during installation, testing, and final acceptance activities to allow for modifications to location or installation. Access includes all necessary resources required to obtain direct physical contact to loudspeakers (front and rear), including: scaffolding, motorized lift, etc.
 - e. Provide ability to reorient loudspeakers in all axes (yaw, pitch, and/or roll) if so requested by Design Consultant during system final acceptance activities.
- 1) Do not perform final suspension connections prior to final acceptance by the Design Consultant including: permanent cable swage, elimination of wire rope service loop, etc.

C. Video

- 1. Coordinate structural backing required for wall mounted flat panel displays/televisions prior to the installation of drywall or other wall materials.

D. Grounding

- 1. Comply with NEC and BICSI grounding requirements.
- 2. Each equipment rack within a row of racks and each row of racks within a room shall be electrically bonded to each other. Bonding shall be via copper ground bus. Any bolts shall fasten to unpainted sheet metal.

3.4 LABELING

- A. Adhere to AVIXA F501.01:2015 "Cable Labeling for Audiovisual Systems" as a minimum standard with additional requirements as described in this paragraph.
- B. Refer to Division 27 Section "Telecommunications Requirements for Audio Video Systems" for all labeling requirements associated with data-related cabling including Category and Fiber Optic cabling.
- C. Develop and utilize a consistent numbering scheme across the entire project. Utilize system names and building references where applicable, such as the rack number or rack room in a distributed system. All labels for input/output plates and control panels shall be consistent with the final room numbering for the facility.
- D. Adhere to the labeling standard across all platforms, including within the DSP programming.
- E. Refer to general notes, the signal flows, and panel and plate details for expected labeling scheme of system equipment and components. Comply with any specific color coding as described.
- F. Document the labeling standard for inclusion in the Operation and Maintenance Data.
- G. Document all labels for the Record Drawings.

H. Pre-approved labelling systems include:

1. Brother P-touch EDGE with HGeS2***PK labels; or
2. Brady Equipment Identification Labels.

3.5 CONTRACTOR'S TESTING, ADJUSTMENT, AND SUBMITTAL REQUIREMENTS

- A. At the completion of the installation, perform the following tests on the system to ensure proper installation and operation. The technical system shall be fully tested with all equipment on site, installed, connected, and fully operational.
- B. Adhere to ANSI/Infocomm 10:2013 "Audiovisual Systems Performance Verification" as a minimum standard with additional requirements as described in this paragraph.
- C. The Contractor shall submit the results of all tests prior to on-site system review by the Design Consultant. Where available, provide documentation obtained directly from the test equipment. Other acceptable documentation includes screen captures, photos, and spreadsheets.
- D. General
 1. Utilize the technical support services offered by the manufacturers of the various technical system components to ensure optimum performance.
 2. All test equipment used for these tests shall be on site during the system final acceptance activities should verification of submitted measurements be required.
 3. Ensure that all equipment is on the jobsite and fully operational. This includes portable (not installed) items and other loose equipment. Remove all devices from shipping or packaging containers, ready for use, and place in equipment storage cabinet.
 4. The functional tests shall include operational tests of all program source equipment (record and playback), wireless microphone system, mixing console, system inputs and outputs, all patch panel receptacles, intercom system, video routing, video distribution, operational controls, AC power sequencing, operation of software, and all system electronics. Functional tests include examination for hum, buzz, hiss, ghosts, hum bars, oscillation, thumps, unintended reception of other signals such as AM or FM radio, TV, CB, ham radio, cell phones, or any other unwanted signals through the system.
 5. Ensure all inputs and outputs are wired to the appropriate devices per construction documents.
 6. Verify system startup and shutdown operates in the proper sequence.
 - a. System head end components shall be energized at the beginning of the startup sequence in an appropriate order to guarantee proper communication with associated devices.
 - b. Loudspeaker power amplifiers shall be energized at the end of the sequence in order to eliminate unwanted transients being reproduced through system loudspeakers.
 - c. System shutdown sequence shall be in reverse order.
 7. Where a system computer is furnished, load and configure all necessary control software. Examples include but are not limited to the following as applicable: wireless microphone

management, amplification management, projector/display management, audio console configuration/control, DSP configuration/management, and active loudspeaker management.

8. Where audio or video digital signal transport is required, ensure all network setup is complete including the installation and licensing of network management application software.

E. Required testing equipment

1. Certain systems/subsystems require testing and documentation via approved test equipment.
 - a. Systems requiring testing via approved devices will be identified below.
 - b. Required test devices will be listed in related sections.
 - c. Provide unified testing results of similar systems. Describe testing procedure including all test equipment used.
 - d. Provide original results from testing equipment (as applicable).
2. Failure to submit testing documentation conducted via approved devices will result in delayed final acceptance by the Design Consultant.
3. Contractors unable to provide required test equipment shall employ the services, at their own expense, of a certified subcontractor to assist in testing and documentation.

F. Audio System

1. Electronics
 - a. Test all system audio electronic components for uniform frequency response from input to power amplifier output:
 - 1) Supply pink noise to a single system input which engages most of the system electronics. For example, connect pink noise to a microphone receptacle on the stage for a Performing Arts facility.
 - 2) With all signal processing bypassed (equalization band pass filters, crossovers, dynamics, etc.), independently route the signal through audio console, DSP, and any other system processing components to an amplifier output.
 - 3) With speaker load disconnected, measure the signal response of the selected amplifier output (to obtain viable measurement results, ensure output level is set to match the ability of the measurement device to display accurate information. This can be accomplished via attenuation of signal or insertion of a speaker level to line level attenuator).
 - 4) Verify the measured response is uniform and matches the reference input signal within ± 1 dB from 30 Hz to 18 kHz.
 - 5) Required test equipment - Signal Generation:
 - a) Terrasonde/Sencore Audio-Toolbox; or
 - b) Japan Audio Society CD-1 test compact disc

- c) NTI Minirator MR-PRO
 - 6) Required test equipment – Measurement Device:
 - a) Rational Acoustics SMAART system v7 or later; or
 - b) NTI Audio XL2 Analyzer; or
 - c) Studio Six Digital Audio Tools RTA or FFT Module, with
 - i) Studio Six Digital iAudioInterface 2
 - b. Repeat measurement for each amplifier output channel.
- 2. Loudspeaker Impedance
 - a. Measure and record the impedance of all loudspeaker circuits at the output of each amplifier. During this process, also check each loudspeaker circuit for shorts to ground.
 - b. Required test equipment:
 - a) Dayton Audio DATS; or
 - b) NTI Minirator MR-PRO; or
 - c) Sennheiser ZP-3; or
 - d) Terrasonde/Sencore Audio Toolbox
 - 2) Unacceptable measurement devices for loudspeaker impedance include the following:
 - a) Digital Multimeter (DMM); or
 - b) TOA ZM-104; or
 - c) TOA ZM-104A
- 3. Loudspeaker Band Pass/Amplifier Assignment Confirmation
 - a. For full range loudspeakers, apply full spectrum pink noise at sufficient level in order to:
 - 1) Verify subjectively that each loudspeaker is emitting full spectrum signal (both woofer and tweeter/horn are operating)
 - 2) Confirm each loudspeaker is connected to the proper amplifier chassis and output channel.
 - 3) Verify proper phase of each loudspeaker.
 - 4) Required test equipment
 - a) Galaxy Audio CPTS Cricket Polarity Tester; or
 - b) NTI Audio MR-PRO generator with XL2 Analyzer; or
 - c) Studio Six Digital Audio Tools Speaker Polarity Module; with

- i) Studio Six Digital iAudioInterface 2 and Type 1 or 2 Test microphone; or
 - ii) Studio Six Digital iPrecisionMic; or
 - iii) Studio Six Digital iTestMic; or
 - d) Studio Six Digital Speaker Pop; with
 - i) Studio Six Digital iAudioInterface 2 and Type 1 or 2 Test microphone; or
 - ii) Studio Six Digital iPrecisionMic; or
 - iii) Studio Six Digital iTestMic
- b. For loudspeakers with multiple band pass sections (bi-amp, tri-amp, etc.), apply appropriately band-limited pink noise at sufficient level to each device or band pass (i.e., high frequency section, mid frequency section, low frequency section):
 - 1) Verify subjectively that each loudspeaker is emitting appropriately band-passed spectrum signal.
 - 2) Confirm each band pass is connected to the proper amplifier chassis and output channel.
 - 3) Verify phase of each band pass
 - 4) Required test equipment
 - a) Galaxy Audio CPTS Cricket Polarity Tester; or
 - b) NTI Audio MR-PRO generator with XL2 Analyzer; or
 - c) Studio Six Digital Audio Tools Speaker Polarity Module; with
 - i) Studio Six Digital iAudioInterface 2 and Type 1 or 2 Test microphone; or
 - ii) Studio Six Digital iPrecisionMic; or
 - iii) Studio Six Digital iTestMic; or
 - d) Studio Six Digital Speaker Pop; with
 - i) Studio Six Digital iAudioInterface 2 and Type 1 or 2 Test microphone; or
 - ii) Studio Six Digital iPrecisionMic; or
 - iii) Studio Six Digital iTestMic
- 4. Loudspeaker Rattle
 - a. Verify each loudspeaker is connected to the respective power amplifier and test each loudspeaker throughout its usable frequency range using 1/3-octave bands of pink noise to ensure loudspeaker and related building systems do not rattle.
 - b. Required 1/3-octave band pink noise sources and test equipment include:
 - 1) Terrasonde/Sencore Audio-Toolbox; or
 - 2) Japan Audio Society CD-1 test compact disc

3) NTI Minirator MR-PRO

5. Loudspeakers Uniformity of Coverage

- a. Perform audio system verification per AVIXA A102.01:2017 (Audio Coverage Uniformity in Listener Areas) for all loudspeakers. Document per guidelines set forth in the standard.

6. Loudspeakers Equalization

- a. Perform sound system equalization to optimize system performance for the intended uses.
- b. Every loudspeaker shall be equalized.
- c. Required test equipment:

- 1) Calibrated Type 1 or Type 2 microphones shall be used
- 2) Studio Six Digital Audio Tools for the classrooms, meeting rooms, conference rooms gymnasium, lobby; with

- a) Studio Six Digital iPrecisionMic; or
- b) Studio Six Digital iTestMic; or

- 3) SmaartLive (most current non-beta version) with SmaartLive approved:

- a) Appropriate laptop
- b) Microphone interface

- 4) EASRA (most current non-beta version) with EASRA approved:

- a) Appropriate laptop
- b) Microphone interface

G. Video System

1. Verify that all video systems utilizing HDMI or DisplayPort cabling are tested to confirm the signal path passes full system bandwidth, full system resolution, HDCP, correct color space and bit depth, correct frame rate, HDR signal and metadata as applicable, and audio as applicable. Required test equipment includes:

- a. Hall Research PGA-VHD; or
- b. Murideo Fox & Hound A/V Testing and Troubleshooting Kit; or
- c. Murideo Fresco Field Test Suite; or
- d. Quantum Data QD780C; or
- e. Purelink HDG 2.0; or

2. Setup and calibrate each visual display using current edition of Spears & Munsil High-Definition Benchmark Disc. Perform calibration with environmental lighting set to level representative of the system while in use. Verify each source and variety of resolutions.

For projector/screen combinations, the screen drop shall be set to maximize observation from all seats and the image shall fill the available space on the screen.

3. Calibrate each video image using a repeatable, calibrated system. Provide documentation for each calibrated image. Results shall also become a part of the Operation/maintenance manuals. Required test equipment:
 - a. Datacolor Spyder5ELITE Display Calibration; or
 - b. SpectraCal CalMAN Ultimate software (most recent version) running on Contractor-provided laptop which exceeds the minimum requirements stipulated by SpectraCal.
 - 1) Supported Meters: as recommended by SpectraCal
 - 2) Supported Pattern Sources: as recommended by SpectraCal; or
 - c. X-Rite ColorMunki Display

H. Adjustment

1. Repair or replace any defects or malfunctions found prior to the commencement of final acceptance activities by the Design Consultant.

I. Testing Documentation Submittal

1. Document the results of all tests and compile into a complete Testing Documentation submittal with the following items:
 - a. Results of the tests detailed herein; and
 - b. Documentation of changes to the systems as a result of any project Change Order, ASI, field directive, Owner Representative direction or the Testing and Adjustment process. Scans of current field set are acceptable for this submittal; and
 - c. Digital photographs or explanation of reasoning for failed test results due to reasons such as site conditions, constraints, equipment availability, equipment failure, direction required from design team or Owner's Representative, etc.; and
 - d. Written notice to the Design Consultant that the system(s) are ready for final acceptance.
2. Include the final approved Testing Documentation package in the Operation and Maintenance Data package.
3. Modify the Record Drawings to include any changes as a result of the adjustment process.

J. Contact the Design Consultant should problems or concerns arise during the testing activities.

K. Transmit the Testing Documentation submittal to the Design Consultant in a timely fashion to allow the Consultant appropriate time for review and comment prior to scheduling of final acceptance. The Consultant cannot visit the site or begin the acceptance phase until the submittal has been approved.

- L. Should the Design Consultant be required to invest time performing some or all of the tests, the Contractor will compensate the Design Consultant for all associated costs.

3.6 FINAL ACCEPTANCE

- A. After completion of the system installation and after the preliminary tests and adjustments are complete, the contractor in conjunction with the Design Consultant shall perform on-site acceptance of the technical system. This process will include, but not be limited to the following, as applicable:
 - 1. Random verification of contractor tests
 - 2. System check-out
 - 3. Tailoring of the technical system's frequency response to the facility's acoustical environment (where required)
 - 4. Observation of video system to verify proper image display
 - 5. Function and operability of the control system.
- B. Provide the services of the designated supervisor and any other technicians who are familiar with the system, for approximately one eight-hour days. Additional time may be required due to Alternates accepted by the Owner's Representative, or due to Addenda or Change Orders (if any) which modify the scope of work. The supervisor shall provide personal assistance during these activities. This duration does not include time for correcting wiring errors, equipment malfunctions, or problems related to the installation of the technical system. This work could occur at any time day, night, weekends, or holidays without additional claims for expense.
- C. At the completion of the final acceptance period, the Contractor shall compile all system configuration settings (files) with copies as required for inclusion in the O&M Manuals described later in these specifications.
- D. In addition, provide the following: hand and power tools appropriate for the type of installation, ladders, lifts, and/or scaffolding as required to reach all high-mounted devices, spare wire and cable of the types used in the installation, selection of wiring fasteners used in the installation, complete set of the most recent reviewed shop drawings, complete set of all manufacturers' original installation/operation/maintenance manuals, and specific test equipment used during the preliminary testing activities.
- E. After the technical system is operational, the Contractor shall provide verbal instruction to designated Owner's Representative as to proper methods of system operation. Video record the instruction class and provide the recording in a usable digital format to the Owner's Representative.
- F. Provide operational assistance for the first major use of the completed system as directed by the Owner's Representative, including being present for: one prior rehearsal associated with the event (if applicable); a technical check immediately prior to the event; and the event itself.

3.7 OPERATION AND MAINTENANCE DATA

- A. At the completion of the project, compile thorough copies of the Operation and Maintenance (O&M) Data per Division 27 Section "General Communications Requirements".
- B. O&M data shall be assembled according to rooms or areas as it relates to the project site. The intent is to allow the Owner's Representative to easily locate information relating to a specific system/room without having to spend an inordinate amount of time searching. Include complete information for each system/room – this may involve duplication of information.
- C. Include ANSI E1.47-2017 (Entertainment Technology – Recommended Guidelines for Entertainment Rigging System Inspections) within the O&M data.
- D. As applicable, save full digital version to the system computer.

END OF SECTION 274100

SECTION 274110 - TELECOMMUNICATIONS REQUIREMENTS FOR AUDIO VIDEO SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide a Telecommunications Structured Cabling System to support a complete and functioning Audio Video (AV) System(s). Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, testing, and transport includes the following passive components:
 - 1. Category Cabling
 - 2. Shielded Category Cabling
 - 3. Faceplates & Shielded Connectors
 - 4. Modular Category Patch Panels
 - 5. Shielded Category Patch Cables
- B. All Category and fiber optic components provided under this section shall comply with Warranty requirements as defined within this section and shall be installed and tested by a certified contractor of the warranty provider. Refer to the Quality Assurance and Warranty paragraphs of this specification for more information on this requirement.
- C. Fiber related equipment and requirements are shown in this section regardless if not shown on the drawings. Information in this section shall be followed should fiber become a part of the AV system(s).

1.2 RELATED SECTIONS

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions, requirements, and recommendations in:
 - 1. Division 27 Section "General Communications Requirements"
 - 2. Division 27 Section "Common Work Results for Communications" for general pathway, firestopping, access panel, identification, and other requirements.
- B. Refer to Division 27 "Audio Video Systems", "Audio Video Systems Equipment", and related sections and drawings for additional requirements and coordination items. Coordinate all work with Division 27 "Audio Video Systems" Contractor.

1.3 CODES, STANDARDS, AND GUIDELINES

- A. In addition to all applicable codes, standards, and guidelines listed in Division 27 Sections "General Communications Requirements", "Audio Video Systems", and Audio Video Systems Equipment", follow the most recent editions of the following:
1. NFPA 70 – National Electrical Code (NEC)
 2. IEEE National Electrical Safety Code (NESC)
 3. ANSI/TIA 455 50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements
 4. ANSI/TIA 455 59A, Measurement of Fiber Point Discontinuities Using an OTDR.
 5. ANSI/TIA 455 60A, Measurement of Fiber or Cable Length Using an OTDR.
 6. ANSI/TIA 455 61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
 7. ANSI/TIA 526 7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant.
 8. ANSI/TIA 526 14 B, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; IEC 61280-4-1 edition 2, Fibre-Optic Communications Subsystem Test Procedure- Part 4-1: Installed cable plant- Multimode attenuation measurement.
 9. TIA-TSB-140 – Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
 10. ANSI/TIA-568 - Commercial Building Telecommunications Cabling Standard
 11. ANSI TIA-569 – Commercial Building Standard for Telecommunications Pathways and Spaces
 12. ANSI TIA-606 – Administration Standard for Commercial Telecommunications Infrastructure
 13. ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources
 14. BICSI - Telecommunications Distribution Methods Manual
 15. BICSI – Information Technology Systems Installation Methods Manual

1.4 DEFINITIONS

- A. Advanced System Warranty – a minimum 20-year warranty covering material and performance of the telecommunications structured cabling system offered by a reputable manufacturer. Refer to the Quality Assurance section of this specification for more information.
- B. Backbone cabling - A cabling system that provides interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- C. Category Cabling – As used herein and in related sections: A generic term for Voice and/or Ethernet grade standardized twisted pair copper cabling and inclusive of Category 3, 5e, 6, 6a, and the like.

- D. Contractor – in regards to this section only, the contractor responsible for providing a complete Telecommunications Structured Cabling System for Audio Video Systems. This contractor shall be a certified contractor of the manufacturer providing the Advanced System Warranty. Where the Contractor of Division 27 Section “Audio Video Systems” does not meet this requirement, they shall engage the services of a subcontractor who meets the requirements of this section.
- E. Direct Attach Method – as defined in ANSI/BICSI 005-2013, the cabling on the remote device end directly attaching (or connecting) to the device through a connectorized cable or hard-wired termination, eliminating the workstation outlet, jack and equipment cord.
- F. Horizontal Cabling
 - 1. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located at the equipment rack. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - a. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector
 - b. Bridged taps and splices shall not be installed in the horizontal cabling
 - c. Splitters shall not be installed as part of the optical fiber cabling
 - 2. The maximum allowable horizontal cable length for Category copper cable is 295 feet (90 meters), which includes total cable length (including vertical routing and slack). Horizontal cables longer than 295 feet shall be optical fiber
- G. Structured Cabling / Telecommunications System – a fully-functional passive telecommunications system (infrastructure), that includes permanently installed Category and fiber optic cable terminated onto a patch panel or outlet.
- H. Technical System Ground – the isolated ground system provided specifically for the Technical (AV) System, as specified in Division 27 section “Audio Video Systems”.
- I. Wet Location - as defined in the NEC, installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

1.5 QUALITY ASSURANCE

- A. Contractor Qualifications
 - 1. Contractor shall be certified for the work required in this section.
 - 2. Contractor shall be certified and capable of offering an Advanced System Warranty from one of the manufacturers listed herein. (Refer to Warranty and Coordination sections for additional requirements.)

B.

C. Personnel Qualifications

1. The person(s) conducting the testing for all Telecommunications cabling shall be a current BICSI Certified Level II Commercial Installer or higher or equivalent training from the Advanced System Warranty manufacturer.
 - a. Submit certificates with pre-construction submittals.
2. Any additional personnel that will be physically installing any part of the Telecommunications Infrastructure covered by this Section shall, at a minimum, be a BICSI Certified Level 1 Commercial Installer in good standing or have equivalent manufacturer training.
3. These requirements are provided as a minimum level of qualification. Any additional or more stringent requirements by the specific manufacturer chosen to provide the proper level or term of warranty as specified in this division shall be met.
4. Additional qualifications may be required if requested in the Substitution instructions in Division 27 Section "General Communications Requirements".

1.6 SUBMITTALS

- A. Follow the requirements for submittals in Division 27 Sections "General Communications Requirements" and "Audio Video Systems".
- B. Pre-construction - Follow exact Division 27 Section "Audio Video System" submittal requirements, with additional requirements as noted:
 1. Manufacturers' Cut-sheets – Additional requirements as follows:
 - a. Product data on cabling shall contain the following:
 - 1) Manufacturers name and logo
 - 2) Cable outside diameter
 - 3) Number of conductors/strands in each cable
 - 4) Gauge or strand thickness
 - 5) Minimum transmission performance rating
 - 6) Cable jacket material and rating
 - 7) Maximum pulling tension
 - 8) Jacket/Sheath color
 - 9) Minimum bend radius
 - a) During installation and post installation, if different

- b. Product data on faceplates, modules, connectors, patch panels, and enclosures shall contain the following:
 - 1) Manufacturers name and logo
 - 2) Material type
 - 3) Performance rating
 - 4) Physical Dimensions
 - 5) Color
- 2. Shop Drawings
 - a. Scaled layout drawings showing modifications to the routing (and support method) of cabling, and the locations where patch panels, Telecommunications outlets, cable types, cable jacket listing information, firestop locations (with quantity and NRTL system number identified), and fiber optic termination panels are to be installed.
 - 1) Each individual outlet on the drawings shall have proposed outlet identification indicated. Coordinate identification labeling with Owner's Representative.
 - b. Scaled enlarged plan and rack elevation drawings showing the locations of patch panels and Rack-Mount Enclosures.
 - c. Unless otherwise required by these specifications, it is permissible to show Work in this section on Division 27 "Audio Video Systems" shop drawings.
- 3. Warranty Information
 - a. Subject to Warranty paragraph, provide sample warranty certificate for the Warranty, indicating manufacturer and their terms/conditions
 - b. Proof that Contractor is certified with the manufacturers products provided.
- C. Project Completion - Follow exact Division 27 Section "Audio Video Systems" submittal requirements, with additional requirements as noted:
 - 1. As part of Division 27 Audio Video Systems – Operation & Maintenance Data submittal, also include the following documentation:
 - a. Warranty Certificates (if applicable)
 - b. Cable routing and Outlet locations
 - c. Test Results, in PDF, spreadsheet, and original test equipment format
 - d. Delivery confirmation of spare Patch Cables delivered to Owner's Representative.
 - 1) Refer to Division 27 "Audio Video Systems", "Audio Video Systems Equipment", and herein for quantities

1.7 COORDINATION

- A. Review pathways and other Work per Division 27 section "Common Work Results for Communications", prior to performing any Work under this section for conformance to all referenced codes, standards, and guidelines.
 - 1. While Division 27 section "Common Work Results for Communications" is being installed, the Contractor Project Manager of this section and the Project Manager of Division 27 "Audio Video Systems" shall make weekly inspections and report any issues to the Prime Contractor for correction prior to installation of any cabling.
 - a. Example – Conduit for Category cables shall not contain more than two 90 degree bends between pull points.
- B. For other Division 27 telecommunications Work, coordinate with Division 27 Telecommunications Contractor(s) prior to bid – similar products shall be by the same manufacturer.
 - 1. This includes:
 - a. Horizontal and backbone cabling
 - b. Copper connectivity
 - c. Fiber connectivity
 - 2. The Advanced System Warranty from this section shall be from the same manufacturer as Division 27 "Structured Cabling System".
- C. Coordinate with Division 27 "Audio Video Systems" contractor for all Work in AV equipment racks.
- D. Coordinate with the Owner's Representative regarding telecommunications standards, cable colors, and other related requirements.

1.8 WARRANTY

- A. The Telecommunications Structured Cabling System (as specified in this Section) requires a standard one-year Warranty. An Advanced System Warranty (as often specified as a portion of a cabling system and typically 20-years in length) is not required. Contractor shall submit product cut-sheets indicating product meets one-year minimum warranty period. Warranty certificates are not required. Comply with Quality Assurance and all testing requirements.
- B. The Telecommunications Structured Cabling System (as specified in this Section) requires an Advanced System Warranty as defined herein. Contractor shall comply with Quality Assurance requirements with respect to Advanced System Warranty certifications and shall be in good standing with the manufacturer.

1. All components, including but not limited to, connectors, patch panels, cabling and all other components considered to be a part of what is commonly referred to as an end-to-end solution for all backbone and cabling systems, shall be warranted for a minimum period of 20 years from the date of installation against defects in materials, equipment and workmanship. This warranty shall also include the performance of these systems. This warranty shall include transmission requirements as specified in applicable ANSI/TIA/IEC/ISO standards for each cable system specified. This warranty shall include all current and future applications and transmission requirements for the installed cable type/system.
2. Warranty shall be guaranteed by a single reputable manufacturer such as:
 - a. Belden
 - b. CommScope
 - c. Hubbell
 - d. Leviton
 - e. Mohawk Cable
 - f. Ortronics
 - g. Panduit
 - h. Superior Essex
 - i. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)
3. This warranty shall extend to Category Neutrik connectors specified in Division 27 "Audio Video Systems". Coordinate with proposed manufacturer of Advanced System Warranty prior to bid to ensure they will extend coverage to this product for this project.
 - a. Include letter in Pre-Construction Product Submittals from manufacturer certifying this requirement will be met.
4. Where warranty is by connectivity manufacturer, all connectivity shall be by said manufacturer and cabling manufacturer shall be compatible for use with the selected connectivity.
5. Where another Division 27 specifies a similar warranty and manufacturer for a telecommunications structured cabling system, provide products and a warranty from the same manufacturer.
6. Advanced System Warranty shall include labor and material. Make repairs or replacements without any additional costs to the Owner's Representative.
7. Perform the remedial work promptly, upon written notice from the Owner's Representative.
8. At the time of Substantial Completion, deliver to the Owner's Representative all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner's Representative and stating the commencement date and term.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL REQUIREMENTS

- A. All cabling and connectivity specified in this section shall be covered by a single Advanced System Warranty. The following manufacturers are conditionally approved to provide the Advanced System Warranty (subject to Coordination requirements in Part 1 of this Section):
 - 1. Belden
 - 2. Hubbell Premise Wiring
 - 3. Leviton
 - 4. Ortronics Network Infrastructure
 - 5. Panduit Network Solutions
 - 6. Superior Essex

2.2 COPPER CABLING – GENERAL REQUIREMENTS

- A. All products in each category shall be from a single reputable manufacturer and comply with Coordination and Warranty requirements per Part 1 of this Section unless otherwise noted.
- B. All connectivity shall be from a single manufacturer.
 - 1. Exception: Certain broadcast and faceplate connections/components as specified.
- C. General Requirements:
 - 1. Cable shall meet the transformation performance and physical specifications of ANSI/TIA-568.
 - 2. Four pairs of 23 AWG solid copper conductors
 - 3. Individually insulated conductors under a common sheath
 - 4. Cable jacket marking: Shall be legible and shall contain the following information:
 - a. Manufacturer's name
 - b. Copper Conductor Gauge
 - c. Pair Count
 - d. UL and CSA listing
 - e. Manufacturer's trade mark
 - f. Category rating
 - g. Sequential distance markings, in one-foot increments
 - 5. Cable colors shall be selected by Owner's Representative
- D. Cables for dry environments:

1. Jacket requirements:

a. Cable jacket shall be suitable for installation in such environments as follows:

- 1) Cable jacket shall be at a minimum riser (CMR | MPR) rated.
- 2) Where any portion of the cable is routed in an air plenum space, cable jacket shall be plenum (CMP) rated.

E. Cables for Wet Environments:

1. A Wet Environment cable is required for pathways in or below slab-on-grade, or where any part of the pathway is external to the building or in a Wet or Damp Location (as defined by the NEC).

2. Cable shall be suitable for contact with standing water.

3. Jacket requirements:

a. Cable jacket shall be suitable for installation in such environments as follows:

- 1) Where cable pathway enters the building within 50' of the termination point, outside plant cable is permitted without an additional rating.

a) Cable pathway requiring greater than 50' of distance to the termination point requires an additional rating as follows:

- i) Where pathway enters building and does not travel in an air plenum space – indoor/outdoor riser rating is required.
- ii) Where pathway enters building and travels in an air plenum space – indoor/outdoor plenum rating is required.

b. Cable jacket rating shall match the specified warranty.

2.3 COPPER CABLING – CATEGORY 6

A. Cables for dry environments

1. Manufacturer shall be from the following list, subject to Coordination and Warranty requirements:

- a. Superior Essex CAT 6+
- b. Hubbell Speedchannel Cable, Category 6
- c. Mohawk Category 6
- d. Panduit TX6000 Copper Cable

B. Cables for wet environments in ducts/conduits

1. Manufacturer shall be from the following list, subject to Coordination and Warranty requirements:
 - a. Superior Essex OSP Broadband Category 6
 - b. Or Approved Equivalent

2.4 COPPER CABLING – CATEGORY 6 SHIELDED

A. Cables for dry environments

1. Requirements
 - a. Aluminum Foil Tape Shield (F/UTP)
 - b. Include drain wire
2. Manufacturer shall be from the following list, subject to Coordination and Warranty requirements:
 - a. Superior Essex CAT 6+ ScTP
 - b. Hubbell Speedchannel FTP Cable, Category 6
 - c. Mohawk Category 6 F/UTP
 - d. Panduit TX6000 Shielded Copper Cable

B. Cables for wet environments in ducts/conduits

1. Requirements
 - a. Aluminum Foil Tape Shield (F/UTP)
 - b. Include drain wire
2. Manufacturer shall be from the following list, subject to Coordination and Warranty requirements:
 - a. Superior Essex OSP Broadband Category 6
 - b. Or Approved Equivalent

2.5 COPPER CONNECTIVITY

A. Connectors/Jacks

1. General requirements:
 - a. Outlets shall meet requirements of TIA-568-C for the associated category cable type.

- b. All 8-position modular jacks are to be wired according to the TIA T568B pin/pair assignments. Category 3 cabling shall not be connected to RJ45 devices.
 - c. Outlet hardware shall be UL listed.
 - 2. Male RJ-45 Category 6 connector
 - a. For installation onto far end of Category 6 cable at the following locations only:
 - 1) In-wall Touch Panels
 - 2) AV equipment transmitters & receivers
 - 3) Other locations where it is not practical to terminate cabling onto a faceplate or into a small Surface Mount (Biscuit) Box.
 - 3. Female RJ-45 Category 6 Jack
 - a. For installation with Category 6 cable into:
 - 1) Dedicated AV LAN faceplates (where no other type of AV connectors are needed)
 - 2) Rack-mounted Patch Panels.
 - 4. Manufacturer for Male and Female shall be from the following list, subject to Coordination and Warranty requirements:
 - 1) Ortronics TracJack
 - 2) Belden Key Connect
 - 3) Hubbell UDX
 - 4) Leviton QuickPort
 - 5) Panduit Mini-Com
 - 5. RJ45 Panel (Faceplate) Connector rated for shielded Category 6 cable
 - a. For installation in custom AV faceplates where other types of AV connectors are also installed.
 - b. Manufacturer shall be:
 - 1) Refer to Division 27 Section "Audio Video Systems"
- B. Faceplates – where only AV LAN connectors are needed, such as behind a monitor or television
 - 1. Requirements
 - a. High impact nylon or stainless steel as selected by the Architect or Owner's Representative with number of ports to allow all modular jacks to be installed as required, and as indicated on the drawings.
 - b. Color shall be as selected by the Architect.

- c. Single gang or double gang, as noted on the drawings or required to provide a complete and functioning system
- 2. Product shall be as follows, subject to Coordination and Warranty requirements:
 - a. From the following list:
 - 1) Belden Key Connect
 - 2) Hubbell UDX
 - 3) Leviton QuickPort
 - 4) Ortronics TracJack
 - 5) Panduit Mini-Com
 - 6) Or Approved Equivalent
 - b. Decora-style inserts
 - 1) Provide as necessary per drawings/details
 - 2) Color shall be as selected by the architect
 - c. Blank inserts
 - 1) Provide blank modules to fill any unused openings in faceplates
 - 2) Color shall match other jack colors
- C. Surface mount ("Biscuit") box – for installation as needed in junction/back box, projector lift, etc. where installation of a faceplate is not practical.
 - 1. Requirements
 - a. Thermoplastic surface-mount style box with number of ports to allow all jacks to be installed as required, and as indicated on the drawings.
 - 2. Product shall be as follows, subject to Coordination and Warranty requirements:
 - a. From the following list:
 - 1) Belden KeyConnect Side-Entry Box
 - 2) Hubbell iStation Surface Mount Box
 - 3) Leviton QuickPort Surface-Mount Box
 - 4) Ortronics TracJack Surface Mount Box
 - 5) Panduit Mini-Com Surface Mount Box
- D. Modular Category 6 Patch Panels
 - 1. Requirements

- a. Be of a modular metal design with snap in frames for individual jacks/connectors.
 - b. Ports and panels shall be easy to identify with label holders for machine-printed and color-coded labels. Rack mountable patch panels shall mount to standard 19" wide racks.
 - c. Comply with referenced standards. Cables shall be terminated with connecting hardware of same category or higher.
 - d. Patch panels shall be provided complete with all mounting hardware, modular jacks, retainers, wire guides, designation strips, etc.
 - e. Provide enough patch panels for the number of cables terminated on the patch panel, plus twenty (20) percent spare. Provide modular jacks to fill each panel completely. Do not leave any blank openings.
2. Product shall be as follows, subject to Coordination and Warranty requirements:
 - a. From the following list:
 - 1) Belden KeyConnect Modular Patch Panels
 - 2) Hubbell UDX Panels
 - 3) Leviton QuickPort Patch Panels
 - 4) Ortronics OR-PHDPJU24
 - 5) Panduit Mini-Com Modular Patch Panels

2.6 COPPER PATCH CABLES/CORDS

A. Requirements:

1. All products in this category shall be from a single reputable manufacturer and comply with Coordination and Warranty requirements per Part 1 of this Section unless otherwise noted.
2. Factory-terminated and tested.
3. Shall meet requirements for of TIA-568-C for the cable category.
4. Provide quantities and lengths as necessary for a complete Audio Video System; coordinate requirements with Division 27 "Audio Video Systems" contractor.
5. In the AV Equipment Room(s)/Rack(s)s, color shall be as directed by the Owner's Representative to correspond with the following VLANs (colors shown below shall be used if no direction provided):
 - a. AV distribution/control (black)
 - b. IP/Control connections (purple)
 - c. Audio Networks (blue)
 - d. HDBaseT distribution (grey)
 - e. Far-end connections (black)

- f. Portable (white).
 - B. Product shall be from the same manufacturer as the bulk cable:
 - 1. Belden
 - 2. Hubbell
 - 3. Leviton
 - 4. Ortronics
 - 5. Panduit
 - C. Provide the following spare patch cords, delivered to the Owner's Representative:
 - 1. Category 6:
 - a. 3 foot:
 - 1) 5% of the total quantity of data ports (four minimum)
 - b. 7 foot:
 - 1) 5% of the total quantity of data ports (four minimum)
 - 2. Category 6 shielded:
 - a. 3 foot:
 - 1) 5% of the total quantity of data ports (four minimum)
 - b. 7 foot:
 - 1) 5% of the total quantity of data ports (four minimum)
- 2.7 COPPER CABLING – ENTRANCE PROTECTION
- A. General
 - 1. Each end of all incoming conductors which are considered to have lightning exposure shall be fully protected in accordance with NEC chapter 8.
 - B. Category 6 Surge Protection:
 - 1. General:
 - a. Shall meet UL 497
 - b. Shall meet TIA 568 Category 6 performance standards
 - c. Shall be capable of being used with POE+ applications

2. Wall-mount Protectors – for single cables, where quantity of cables in Equipment Room needing protection is 6 or less:
 - a. Manufacturer shall be:
 - 1) Emerson Edco CAT6-POE
 - 2) ITWLinx SurgeGate Series CAT6-75
3. Rack-mount Protectors – where more than 6 cables in an Equipment Room require surge protection:
 - a. Shall be rack-mountable in 19" wide equipment rack
 - b. Provide quantity of Category 6 protectors/modules required for install, plus 25% spare
 - c. Manufacturer shall be:
 - 1) APC ProtectNet Chassis (PRM24) with Cat 6 Surge Modules (PNETR6)
 - 2) Emerson Edco RM-CAT6-**POE
4. Far-end Protection – exterior Category 6 outlets shall have integral protection against power surges and transients. Where AV equipment does not have integral protection, provide the following at the far-end of each exterior Category 6 outlet:
 - 1) Blackbox CAT6 In-Line Surge Protector
 - 2) Emerson CAT6-5POE-FF

2.8 TESTING EQUIPMENT - COPPER

- A. The following Test Equipment is Conditionally Approved for Contractor use.
- B. Category 3 and 6 Cable Tester
 1. Requirements
 - a. The field tester shall be a level III or greater.
 - b. The field tester shall meet the requirements of TIA-568.
 2. Available Manufacturers. Contractor may submit other cable testers that meet specification requirements.
 - a. Category Cable Tester
 - 1) Fluke www.flukenetworks.com
 - 2) Greenlee www.greenlee.com
 - 3) Ideal www.idealindustries.com

- 4) JDSU
- b.

www.jdsu.com

PART 3 - EXECUTION

3.1 CABLE INSTALLATION - GENERAL

A. General

1. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications.
 - a. There shall be no splices or mechanical couplers installed between the cable points of origin and termination except as shown on the Drawings and/or specified herein.
 - b. No Category 6 cables shall exceed the allowed maximum distance of 295 feet (90 meters) by TIA-568-C.
2. Unless otherwise noted, all cables shall be routed through the building cable tray/conduit/surface-mounted raceway system. Refer to the Electrical or Telecommunications drawings for layout of cable tray.
 - a. All cables shall be suitable for installation in their environment, either plenum (CMP, MPP, OFNP, or OFCP) or riser (CMR, MPR, OFNR, or OFCR) rated, unless otherwise noted.
 - b. Cables installed in Wet Locations as defined by the NEC or in these construction documents (such as conduits embedded or routed below a ground floor slab) shall be suitable for installation in such environments and follow the installation requirements for outside plant cables as specified herein.
3. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or any other method shall not be used to attach cables to cable supports or to create cable bundles.
 - a. Except when supported by ladder racking within each AV Equipment Room/Rack, UON.
4. At the same time cables are pulled into a conduit also install a pull cord to facilitate future cable pulls along those. Use polypropylene or monofilament plastic line with not less than 200 lb (90.72 kg) tensile strength. Leave at least 12 inches (304.8 mm) of slack at each end of pull cord. Install permanent labeling at each end for identification.
5. Do not install kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable
6. Comply with all referenced standards and guidelines.

7. Cables shall be masked, covered, or otherwise protected from being painted or coming in contact with any other substance that may degrade the performance or physical characteristics of the cable jacket or insulation over time.
 8. Where distance allows all cables shall be provided with slack/service loops at each end of the cable, one at the device (if not in conduit) and one at the equipment room/enclosure. Each slack/service loop shall be:
 - a. A minimum of 8 feet (2.44 meter) in length, UNO
 - b. Configured in a loosely formed figure eight configuration (ie. not coiled)
 9. Use of any cable pulling lubricants is prohibited.
 - a. Where lubricant is deemed necessary by the contractor to facilitate installation of cable in conduit, submit RFI with explanation, effected conduit run, proposed lubricant type, letter from cable manufacturer indicating proposed lubricant will not damage or degrade cable, and a letter from the manufacturer providing the Advanced System Warranty (if applicable) that the use of this lubricant will not exclude that cable run from the required warranty.
- B. Outside plant cable installation: for cables placed in Wet or Damp Locations (as defined by the NEC) or as required by these construction documents. (I.e. all cables which extend beyond the footprint/envelope of the building or pathways leading to floor-boxes embedded in a ground floor slab)
1. Coordinate installation of conduit serving Wet Locations so conduit stubs up directly into Equipment Room, if practical.
 2. If conduit serving Wet Locations cannot be installed so conduit stubs up directly into Equipment Room, utilize IMC or RMC conduit to within 50 feet (15.24 meter) of the cable termination point.
 3. No portion of outdoor only (unlisted) cables may be installed with the cable jacket exposed in any plenum or other air handling space nor shall they be allowed to transition between different levels of the building.
 4. Where specifically allowed by these construction documents cable jackets rated for dual use by a NRTL, such as an indoor/outdoor rated cable may be used.
 - a. These cables may be installed in locations within the building in which the cable jacket is appropriately rated to meet all applicable building codes.
 5. All cables which extend beyond the envelope/footprint of the building or serving outlets/devices on external walls or roofs shall be installed with entrance protectors in accordance with this section.

3.2 CONNECTOR INSTALLATION

- A. Furnish and install all cable connectors as shown on the Drawings.

- B. Provide number of connectors as required by the Drawings and as required by these documents, where the number of connectors required does not fill the entire faceplate provide blank inserts so that no opening is left.
- C. The provision and termination of connectors from each cable shall be done as follows:
 - 1. Where connector types are identified on the applicable drawings or in the specifications, furnish and install the specified connectors on the specified cables. Installation of the connectors shall be in accordance with the manufacturer's printed instructions.
 - 2. All installed connectors, regardless of type, method of procurement or permanency, shall be adequately protected during and after installation.
- D. Copper Connector Installation
 - 1. Terminate all four pairs of each cable on one outlet jack. Ensure shield/foil and drain wire are properly installed according to manufacturer's instructions.
 - 2. Furnish and install all cable connectors as shown on the Drawings or as indicated herein, unless otherwise noted.
 - 3. The provision and termination of connectors for each cable shall be done as follows:
 - a. Where connector types are identified on the applicable drawings or in the specifications, Furnish and install the specified connectors on the specified cables. Installation of the connectors shall be in accordance with the manufacturer's printed instructions.
 - b. All installed connectors, regardless of type, method of procurement or permanency, shall be adequately protected during and after installation.

3.3 FACEPLATE INSTALLATION

- A. Furnish and install all faceplates in locations as shown on the Drawings.
 - 1. Where co-located on AV faceplates, coordinate installation with Division 27 "Audio Video Systems" contractor.

3.4 ENTRANCE PROTECTION INSTALLATION

- A. Install grounding wire as straight as possible from protector to the Technical System Ground.
- B. Grounding and bonding
 - 1. Bond all metallic shields and armored jacketing material for all incoming cables as close as practicable to the entry into the building.

2. Bonding conductors shall be connected to the Technical System Ground and in accordance with NEC chapter 8.

3.5 CABLE IDENTIFICATION

- A. Label all cabling with machine-printed labels according to direction from the Owner's Representative. If no labeling scheme is provided, submit RFI through appropriate channels indicating the proposed labeling scheme.
 1. Shop drawings shall include signal flow diagrams and floor plans showing cable/outlet endpoints for each conductor.
- B. Cables shall be labeled within 6" at each end.
- C. All cable labels shall be thermal-transfer type and utilize self-adhesive labels. The following are approved manufacturers:
 1. Brady, IDXPRT
 2. Hellermann Tyton, Spirit 2100
 3. Panduit LS9
 4. Or Approved Equivalent

3.6 CABLE TESTING - GENERAL

- A. Pre-installation testing:
 1. Visually inspect all cables, cable reels/boxes, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
 2. Mark reels or boxes as tested/inspected.
 3. Do not install any cable with less than the manufacturer's guaranteed number of serviceable conductors.
 4. The field-test instruments shall be within the calibration period recommended by the manufacturer and shall contain the most recent software and firmware provided by the manufacturer prior to testing.
- B. Post-installation testing:
 1. Conduct cable testing as described below upon completion of installation. Test fully completed systems only. Piecemeal testing is not acceptable.
 2. Provide testing in accordance with manufacturer's requirements for a fully warranted cabling system(s) as required by these Contract Documents.
 3. All outlets, cables, patch panels, and associated components shall be fully assembled and labeled prior to field testing.
 4. Invite the Owner's Representative and Design Consultant to witness, review, or both witness and review field-testing.

- a. The Owner's Representative and the Design Consultant shall be notified of the testing start date (2) weeks before testing commences.
5. Remove all defective cables from pathway systems.
6. All cables that fail testing are to be corrected prior to substantial completion and acceptance by the Owner's Representative. Replace entire cable if bad pair or conductor is found. Do not abandon cables in place.
- C. All test results and corrective procedures are to be documented and submitted to the Design Consultant as part of the Project Completion submittal(s) and the Contractor's Testing and Adjustment requirements of Division 27 Section "Audio Video Systems".
 1. Submit updated Record Drawings along with completed Test Results. Record Drawings shall have final outlet labels that correspond to the identification used in the Test Results.
 2. Format of test results shall be:
 - a. Electronic Database Test Results - Abbreviated results, in PDF and Excel/CSV file formats, shown in numerical / alphabetical order in a spreadsheet which depicts the following:
 - 1) Project Name
 - 2) Date of Preparation
 - 3) ID of Work Area Outlet / connector being tested
 - 4) Date of test
 - 5) Contractor's Name
 - 6) Media Type
 - 7) Make, Model and Serial Number of test equipment used
 - 8) Date of Last Calibration
 - 9) Names of Test Crew
 - 10) Serving Communications Room Number
 - a) All tests shall be submitted in numerical / alphabetical order by Communications / Equipment Room.
 - 11) Category of cable being tested
 - 12) Abbreviated Test Results depicting Pass, Fail status
 - b. Full Test Results – test results saved within the field-test instrument and then transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of the test records, shown in numerical / alphabetical order in the file format of the tester (example: .mdb file, and unaltered).
 - 1) Project Name
 - 2) Date of Preparation
 - 3) ID of Work Area Outlet / connector being tested
 - 4) Date of test

- 5) Contractor's Name
- 6) Media Type
- 7) Make, Model and Serial Number of test equipment used
- 8) Date of Last Calibration
- 9) Names of Test Crew
- 10) Serving Telecommunications Room Number

a) All tests shall be listed in numerical / alphabetical order by Communications / Equipment Room.

- 11) Category of cable being tested
- 12) Full Test Result data

D. Final Acceptance Review

1. Final Acceptance Review will take place in conjunction with the Design Consultant Commissioning as specified in Division 27 Section "Audio Video Systems". Final Acceptance Review cannot take place until Design Consultant receives Test Results and Record Drawings.
2. Provide a minimum of two suitably qualified cabling/testing technicians to be present on-site for a period of one hour during the scheduled Final Acceptance Review. Be prepared to conduct on-the-spot cable tests.
3. During the Final Acceptance Review, the Owner's Representative or the Design Consultant may select a random sample of up to 10% of the installed links for the Contractor to retest. The measured results obtained from the random sample shall be compared to the Test Results provided by the Contractor.
4. If 10% or more of the randomly tested cables differ in terms of the pass/fail determination or in cable length, the Owner's Representative and Design Consultant reserve the right to require a re-testing of 100% of the cable plant by the Contractor or a qualified 3rd party at the Contractor's expense.
5. Successful equipment performance tests do not relieve the Contractor from the specified testing, repair, and documentation requirements.

3.7 CABLE TESTING - COPPER

- A. Perform all manufacturer recommended and required test calibration procedures prior to testing any cables.
- B. Four-Pair Cables:
 1. After terminating both ends of all 4-pair cables, but before any cross-connects are installed, test these cables for the following:
 - a. Category 6
 - 1) Wire map

- 2) Length
- 3) Insertion loss
- 4) Near-end crosstalk (NEXT) loss.
- 5) Power sum near-end crosstalk (PSNEXT)
- 6) Equal-level far-end crosstalk (ELFEXT)
- 7) Power sum equal-level far-end crosstalk (PSELFEXT)
- 8) Return loss
- 9) Propagation delay
- 10) Delay skew
- 11) Alien Crosstalk (AXTalk) – Follow manufacturer's instructions for method

C. Two-Pair Cables:

1. After terminating both ends of all 2-pair cables, but before any cross-connects are installed, test these cables for the following:

a. Category 3

- 1) Wire map
- 2) Length
- 3) Insertion loss
- 4) Return loss
- 5) Propagation delay

- D. All installed cabling Permanent Links shall be field-tested and pass the test requirements and analysis above. Any Permanent Link or Modified Permanent Link that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected Permanent Link meets performance requirements. The final and passing result of the tests for all Permanent Links shall be provided in the test results documentation.

3.8 ACCEPTANCE

- A. All Work in this section is subject to the Project Completion and Schedule requirements of Division 27 section "Audio Video Systems".

B. After Final Acceptance Review:

1. Complete all Punch List items.
2. Retest effected cables.
3. Among other requirements, submit updated and complete Record Drawings/Test Results and the Advanced System Warranty certificate as part of Division 27 Audio Video Systems – Operation and Maintenance Data Submittal.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

END OF SECTION

SECTION 274116 - AUDIO VIDEO SYSTEMS EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes the equipment for the audio-video (AV) system (hereafter referred to as the "Technical System").

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section, as do the following:
 - 1. Division 27 "Audio Video Systems".

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Division 27 Section "Audio Video Systems" for general product requirements.
- B. All components of the technical system equipment shall be provided and installed by a qualified contractor as outlined in Division 27 Section "Audio Video Systems".
- C. All electronic audio devices shall have electronic or transformer balanced inputs and outputs except for specific program source equipment and mixing console inputs and/or outputs. If an electronic device specified or furnished has an unbalanced input and/or output, make provisions to balance said input/output (i.e., active signal balancing device as approved) unless other arrangements have been agreed upon with the Design Consultant.

2.2 COMMON EQUIPMENT

- A. Refer to Division 27 Section "Audio Video Systems" for common equipment and components.

2.3 LOUDSPEAKERS – INSTALLED

- A. General loudspeaker requirements:

1. Loudspeaker, and related mounting bracket(s) where appropriate, color shall be as selected by the Architect from the available color selection offered from each loudspeaker manufacturer.
 2. Utilize the most recent manufacturer-recommended DSP settings if available.
- B. Loudspeaker – SB|8|4x2|-|SP, surface mount soundbar, 8 ohm, 2x4-inch loudspeaker, powered:
1. JBL PSB-1; or
 2. Approved equal.

2.4 FLAT PANEL DISPLAY/TELEVISION MOUNTS

- A. Unless noted otherwise, provide the appropriate mount for each display furnished. Mount color as selected by Architect. Match mount to the display and the mounting surface.
- B. Full assembly (display, mount, and all associated connections/equipment) shall be adequately supported with the appropriate safety factor to building structure. Appropriate structural backing/support shall be provided. No mounts shall fasten directly to the roof deck. Refer to submittal requirements.
- C. Furnish all components to provide a complete installation, including fastening systems suitable for the mounting surface.
- D. All recessed or built-in displays/televisions require shop drawings showing the surrounding architecture to ensure proper fit and ventilation requirements.
- E. Refer to drawings for anticipated mount type required for each display location.
- F. Provide outdoor rated mount variants in locations as applicable.
- G. Mounts shall be selected and installed to ensure the full display/mount assembly meets all ADA requirements, including Protrusion Limits into Circulation Paths of no more than 4" (as defined by the ADA Accessibility Guidelines). Additional considerations may include:
 1. The use of thin mounts in lieu of standard depth display mounts to reduce mounting depth.
 2. Where wall standoffs are utilized, ensure overall depth is no greater than 4".
 3. The use of "right angle" plugs or terminations may be required to maintain minimum cable bend radius.
 4. The use of recessed back boxes may be required to accommodate plugs or terminations and any display mounted equipment.
 5. The use of recessed back boxes with thin profile articulating mounts may be utilized in lieu of thin mounts.

- H. Mount selection shall not be finalized before receiving make and model information for Owner-furnished displays.
- I. Flat Panel Mount – Wall – Articulating: articulating arm wall mount that pulls out, rotates, and tilts down, fully adjustable, lockable, sized for display as required:
 - 1. Chief TS***T Series (OD for outdoor series); or
 - 2. Peerless SA Series (ESA for outdoor series); or
 - 3. Premier Mounts AM Series.
- J. Flat Panel Mount – Wall – Articulating ADA: articulating arm wall mount that pulls out, rotates, and tilts down, fully adjustable, lockable, sized for display as required; with recessed back box for retain mount within wall cavity, maximum depth of mount at face of wall no greater than 0.5":
 - 1. Chief RIW Series mount with PAC501B in-wall back box; or
 - 2. RP Visuals Wallmate Series; or
 - 3. Approved equal.
- K. Flat Panel Mount – Ceiling - Pole: ceiling mounts one display from 1.5" pipe, fully adjustable, locking, sized for display as required:
 - 1. Chief FUSION CM Series; or
 - 2. Peerless PLCM Series (ECMU for outdoor series); or
 - 3. Premier Mounts CTM Series.
- L. The maximum allowable lateral movement of a ceiling pole mounted display assembly shall not exceed one inch at the bottom of the display. Where these conditions cannot be met by the standard installation requirements, the following components are approved where necessary to facilitate compliance with this guideline.
 - 1. Where pole length creates excessive "shaking" of the display under normal operating conditions due to structural deflections, the following components may be utilized to mitigate the issue.
 - 2. Mitigation methods do not alleviate the Contractor's responsibility for proper rigid support methods to prevent these concerns.
- M. Flat Panel Mount Accessory – Lateral Bracing – Wall: Provides additional lateral support to flat panel displays or other equipment suspended by NPT pipe assemblies. For use in close proximity to wall or other structural element. Minimum two (2) assemblies required per installation. Install per Anvil International Seismic-10.13, pg. 5.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Anvil International Q Brace Clamp, P/N: fig.770; with
 - a. Anvil International Sway Brace Swivel Attachment, P/N: fig.770; or
 2. Approved equal.
- N. Flat Panel Mount Accessory – Lateral Bracing – Cable: Provides additional lateral support to flat panel displays or other equipment suspended by NPT pipe assemblies. For use when primary support pipe is not in close proximity to wall or other structural element.
1. Display Devices Pole Stabilizing Kit; or
 2. Approved equal.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS

- A. Refer to Division 27 Section "Audio Video Systems" for common requirements.

3.2 LABELING

- A. Refer to Division 27 Section "Audio Video Systems" for labeling requirements.

END OF SECTION

SECTION 275123 - INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 SECTION INCLUDES

- A. System Description
- B. Singlewire InformaCast Software
- C. Network Switch
- D. IP Speaker
- E. IP Amplifier
- F. Structured Cabling System

1.2 RELATED REQUIREMENTS

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions, requirements, and recommendations in Section 270010 General Communications Requirements.

1.3 ABBREVIATIONS AND ACRONYMS

- A. DHCP: Dynamic Host Configuration Protocol
- B. FXO: Foreign eXchange Office
- C. H.323: Audio and Video Protocol
- D. IP: Internet Protocol
- E. SIP: Session Initiation Protocol

1.4 REFERENCE STANDARDS

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

- B. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.
- C. UL 60950 - Safety of information technology equipment; current.
- D. UL 813 - Standard for Commercial Audio Equipment; current.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.6 SUBMITTALS

A. Pre-bid submittal:

- 1. For all products for which an alternate product is desired to be considered as an approved equivalent or acceptable substitution provide submittals with sufficient detail for review by the Engineer. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information.

B. Pre-construction submittal:

1. Submit Shop Drawings.

- a. Submit layout drawings of the communication system and all components. Indicate wiring type and proposed routing to each device.
- b. Submit drawings of control equipment showing all major components and positions in the rack.
- c. Provide block diagrams showing components and relative connections and proposed zones.
- d. Submit amplifier sizing calculations.

- 2. Submit the complete list of materials proposed for this work in accordance with Specification

- a. Provide a typed list indicating part name, manufacturer, part number, and color (if applicable) for products specifically identified herein by the exact and complete part number (no wild-card characters)
 3. Submit manufacturers cut sheets or catalog cut sheets of each of the components to be used for products not specifically identified herein by exact part number.
 4. Submit manufacturer's data on paging systems and accessories.
 5. Submit data sheets on equipment provided.
- C. Project completion submittal:
1. As-Builts
 - a. Submit layout drawings of paging system including speakers, head-end equipment, volume controls and other accessories. Indicate wiring sizes and routing to each device.
 - b. Submit drawings of control equipment showing all major components and positions in the rack.
 - c. Provide block diagrams showing components and relative connections and zones.
 2. Submit data sheets on equipment provided.
 3. Installation wiring diagrams and instruction manuals
 4. Submit a certificate showing a completion of installation, programming, and service training from the system manufacturer.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, 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.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- D. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

- E. All manufactured equipment shall be installed as recommended by the manufacturers, or as indicated in their published installation manual.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. SingleWire InformaCast

1. Alerts to Many Devices

a. Cisco Phone Alerts

- 1) InformaCast can send audio and text alerts to groups of Cisco IP phones. The Owner can send an alert through the InformaCast user interface or by picking up a phone, dialing the designated extension, and speaking.

b. IP Speaker Alerts

- 1) InformaCast can send audio and/or scrolling text alerts to IP speakers and clocks on your network. The Owner can choose to send alerts to all the speakers on your network or just the ones located in specific buildings, wings, or floors.

c. Alerts to Two-Way Police/Security Radios

- 1) InformaCast can send alerts to groups of police/security radios when you need to notify law enforcement or security officers of an emergency. Alerts are delivered as one-way audio broadcasts

2. Types of Alerts

a. Live, Audio Alerts

- 1) Audio alerts that are delivered in real time as you speak. You can initiate this type of alert by pressing a button or dialing an extension on a Cisco IP phone. The alert is delivered to pre-configured groups of Cisco IP phones.

- b. Adhoc Audio Alerts
 - 1) Audio alerts that are recorded live, but not delivered until you're satisfied and you trigger the alert to go out. You can re-record as many times as you'd like.
 - c. Pre-Recorded Audio and Text Alert
 - 1) Audio and text alerts that are created during a non-critical time. You can assign groups of devices that you want to receive these alerts, set how you'd like someone to be able to trigger these alerts, and save them in the system. They'll then be available for quick and easy delivery during an emergency situation.
3. Intelligent Emergency Alerting
- a. Emergency Call Monitoring, Recording, and Alerting
 - 1) InformaCast can detect when someone in your facility dials 911 or an internal emergency number. When this happens, InformaCast sends an alert to internal safety team members, managers, local first responders and other designated people. The alert includes information about when, where, and by whom the call was placed to facilitate a fast, organized response.
 - b. Weather Monitoring and Alerting
 - 1) InformaCast monitors Common Alerting Protocol (CAP) feeds from Federal agencies like the National Weather Service and NOAA. You can configure it to forward only alerts that pertain to your geographic area. The alerts can go to facility speakers, specific phone numbers or email addresses, and more.
 - c. Conference Call Management
 - 1) When an emergency alert goes out, InformaCast can bring key people together into a conference call to coordinate an emergency response. These people will receive a phone call with a recording of the initial alert and an invitation to join the conference call bridge. They can invite other people to join the call by providing them with a designated extension.
 - d. Website RSS Feed Monitoring
 - 1) You can configure InformaCast to monitor RSS feeds from designated websites. Whenever those feeds are updated with new content, it will send an alert to a designated group of people.
4. Alerts to Third Party Applications

- a. Alerts to Twitter
 - 1) You can assign Twitter accounts to recipient groups in InformaCast and send text alerts to those accounts in the same way you would an IP phone or other device.
 - b. Alerts to WordPress
 - 1) You can assign WordPress websites to recipient groups in InformaCast and send text alerts to those websites in the same way you would an IP phone or other device.
 - c. Alerts to Cisco® Jabber™ Instant Messaging Clients
 - 1) You can send InformaCast alerts to people via the Cisco Jabber IM client. Alerts are delivered as instant messages, and include the short text of the InformaCast alert and a link to play back audio. The Jabber IM plugin is compatible with Cisco's on-premises and of-premises solutions, Cisco Unified Communications Manager IM, Presence, and WebEx.
 - d. Inbound and Outbound Email Alerts
 - 1) When InformaCast receives an email from a designated email account, it can automatically send out a text and/or audio alert. Alternatively, InformaCast can send text/audio alerts to groups of email accounts.
5. Simple Scheduling Interface
- a. Bellsand Announcements
 - 1) Anyone who is authorized to use InformaCast can make day-of changes in the user interface, even after the schedule is set. You can use this same method to schedule end-of-day announcements.
 - b. Shift Change Alerts
 - 1) You can schedule a 5-minute warning towards the end of a shift so people know to wrap up their work, clean up, etc., and then an alert that marks the end of the shift. This is especially helpful for organizations that have different crews for first, second, and third shift.
 - c. Closing Announcements
 - 1) You can schedule InformaCast alerts to let people know when your store or facility is closing, when visiting hours are over, or when it's the end of the work day.

6. InformaCast is compatible with most versions of Cisco Unified Communications Manager and most Cisco IP phone models. See full compatibility lists at www.singlewire.com/compatibility-matrix
7. There are several technology vendors that produce InformaCast-compliant IP speakers, panic buttons, contact closures, zone controllers, digital displays, and third-party applications. Learn more about these companies at www.singlewire.com/ecosystem-partners
8. Technical Requirements (Please see Hardware Requirements on (www.singlewire.com/compatibility-matrix for updates)
 - a. VMware ESXi 4.0 or later
 - b. 4 Gb of memory
 - c. A dedicated virtual CPU (vCPU) is required
 - d. A single virtual NIC configured for bridging, not NAT; InformaCast will not work through NAT'd
 - e. network connections
 - f. 80 Gb disk, which can be either local disk or SAN-attached disk (the SAN may be of any type supported by VMware)
 - g. CUCM 8.5 or newer with multicast-enabled network (unicast gateway is available for WAN if needed)
9. InformaCast Advanced are licensed according to the number of devices with InformaCast alerts. These could include: Cisco IP phones, InformaCast-compliant IP speakers, and networked Windows/Mac machines running the InformaCast Desktop Notifier. Maintenance contracts are available for purchase in 1-5 year subscriptions and provide access to upgrades, patches, and the Singlewire Support Team. For pricing and ordering information, contact your authorized Cisco re-seller or a Singlewire representative.

2.2 SINGLEWIRE INFORMACAST SOFTWARE

- A. Singlewire InformaCast advanced notification software and licensing will be furnished and installed by the Owner.

2.3 NETWORK SWITCHES

- A. Coordinate with Owner Furnished, Owner Installed (OFOI) switch.

2.4 IP SPEAKER

A. Manufacturers

1. Basis of Design:
 - a. Pendant Mount IP Speaker - Black
 - 1) AtlasIED IP-PM8GD-B
 - 2) Valcom VIP-415-IC
2. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following, unless specified otherwise.
 - a. Advanced Network Devices
 - b. AtlasIED
 - c. CyberData
 - d. Digital Acoustics
 - e. Telecor
 - f. Valcom
 - g. Wahsega
 - h. Substitution: See Section 016000 - Product Requirements
 - 1) Substitutions will not be considered unless formally submitted during the bidding process as an RFI. If accepted, product will be added in an Addendum.

B. Requirements

1. Singlewire InformaCast® compliant
2. Power over Ethernet (PoE) 802.3af compliant
3. 8" loudspeaker

C. Requirements

1. Singlewire InformaCast® compliant

2. Power over Ethernet (PoE) 802.3af compliant
3. Product is stated to be paintable by the manufacturer
4. IP66 compliant

D. Location Type

1. Apparatus Bays
 - a. Vandal-resistant cover

2.5 IP AMPLIFIER

A. Manufacturers

1. Basis of Design:
 - a. IP Intercom
 - 1) AtlasIED IP-ZCM (15 Watt)
 - 2) Valcom VIP-851-70/100-IC (20W)
2. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following, unless specified otherwise.
 - a. AtlasIED
 - b. Valcom
 - c. Substitution: See Section 016000 - Product Requirements
 - 1) Substitutions will not be considered unless formally submitted during the bidding process as an RFI. If accepted, product will be added in an Addendum.

B. Requirements

1. Singlewire InformaCast® compliant
2. Power over Ethernet (PoE) 802.3af compliant
3. Inputs
 - a. 2 General Purpose Inputs (GPI)

- b. Microphone input
- 4. Outputs
 - a. Line level audio
 - b. 15-Watt 70.7V Amplified output to drive analog speakers
 - c. 1 General Purpose Output (2A @ 30VDC)

2.6 IP TO LINE-OUT AUDIO ADAPTER

A. Manufacturers

- 1. Basis of Design:
 - a. IP Intercom
 - 1) Advanced Network Devices ZONEC2
 - 2) CyberData 011280
 - 3) Digital Acoustics IP7-FX-S3-IC
 - 4) Valcom VIP-801A-IC
- 2. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following, unless specified otherwise.
 - a. Advanced Network Devices
 - b. CyberData
 - c. Digital Acoustics
 - d. Valcom
 - e. Substitution: See Section 016000 - Product Requirements
 - 1) Substitutions will not be considered unless formally submitted during the bidding process as an RFI. If accepted, product will be added in an Addendum.

B. Requirements

- 1. Singlewire InformaCast® compliant

2. Power over Ethernet (PoE) 802.3af compliant
3. Inputs
 - a. Line level audio
4. Outputs
 - a. Line level audio

2.7 STRUCTURED CABLING SYSTEM

- A. See Section 271000 for structured cabling requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions
 1. Verify receptacles are available to power the system.
 2. Verify pathways are acceptable prior to installing cables.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General
 1. Install in accordance with manufacturer's instructions.
 2. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.
 3. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items, may include hardware, rack panels, 66-style Termination Blocks etc., and other devices that are required for installation.
 - a. Furnish and install necessary equipment, back boxes, supports and enclosures.
 - b. Furnish and install all necessary wire.

- c. All work shall be performed and completed in a thorough and workmanlike manner and in accordance with the manufacturer's instructions.
- d. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- e. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.
- f. Weatherproofing: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
- g. Connect wiring according to Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
- h. Mounting of Stations: Surface mount at 46 inches above finished floor to center of station unless otherwise indicated.
- i. Provide physical isolation from speaker microphone, telephone, line level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

B. Wiring Methods

- 1. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters[, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used]. Conceal raceway and cables except in unfinished spaces.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Comply with requirements for raceways and boxes specified in Section 270500 – Common Work Results for Communications.
- 2. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- 3. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

C. Installation of Cables

1. Comply with NECA 1.
2. General Requirements:
 - a. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
 - b. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
 - c. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - d. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
 - e. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 - f. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
3. Open-Cable Installation:
 - a. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
 - b. Suspend cable not in a wireway or pathway a minimum of 8 inches above ceiling by cable supports not more than 60 inches apart.
 - c. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
4. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

D. Grounding

1. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.
2. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.
3. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.
4. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
5. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
6. Install grounding electrodes as specified in Section 270500 - Common Work Results for Communications.

E. SYSTEM PROGRAMMING

1. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

F. Commission InformaCast Software

1. Set up Bell/Tone Scheduler. Coordinate Bell/Tone Schedule with the Owner.
2. Set up four (4) pre-recorded audio messages. Coordinate audio messages with the Owner.
3. Add and configure all IP components (such as Speakers) that Contractor is installing. Test each speaker after adding to InformaCast Software. Provide the following for each speaker by importing a comma-separated value (CSV) text file containing the relevant information indicated below.
 - a. 1 - MAC address
 - b. 2 - Name (limited to 50 characters)
 - c. 3 - Description (limited to 200 characters)
 - d. 4 - Volume

- e. 5 – Dial Code (optional)
- 4. Add and configure Recipient Groups. Coordinate Recipient Groups with the Owner prior to implementing into the software. Anticipate to add the following recipient groups at minimum.
 - a. All Call – all speakers in the facility.
 - b. Per Floor
- 5. Cisco IP Phones will be furnished by the Owner and installed by the Contractor. Contractor will not be responsible to adding or configuring the IP phones furnished by the Owner into the InformaCast software, but the contractor shall facilitate in providing speaker information (such as MAC addresses, location description) as required to create intercom sessions from an IP phone through Cisco Unified Communication Manager. The Cisco Unified Communications Manager will also be provided by the Owner.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
 - 1. Schedule tests with at least seven days' advance notice of test performance.
 - 2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: Test originating station-to-station[, all-call, and page] messages at each intercommunication station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
 - 4. Frequency Response Test: Determine frequency response of two transmission paths[, including all-call and paging,] by transmitting and recording audio tones. Minimum acceptable performance is within 3 dB from 150 to 2500 Hz.
 - 5. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
 - a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at[paging] speakers.
 - b. Repeat test for three speaker microphones.

- c. Minimum acceptable ratio is 45 dB.
 - 6. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each intercom[, paging, and all-call amplifier]. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.
 - 7. Power Output Test: Measure electrical power output of each paging amplifier at normal gain settings of 150, 1000, and 2500 Hz. Maximum variation in power output at these frequencies is plus or minus 3 dB.
 - 8. Signal Ground Test: Measure and report ground resistance at system signal ground. Comply with testing requirements in Section 270500 - Common Work Results for Communications.
 - D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.
 - E. Educational intercommunications and program systems will be considered defective if they do not pass tests and inspections.
 - F. Prepare test and inspection reports.
- 3.4 SYSTEM STARTUP
- A. Provide manufacturer's field representative to perform systems startup.
 - B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.
 - C. Perform programming of system and audio level adjustments.
- 3.5 CLEANING
- A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner's representative.

3.6 COMMISSIONING

- A. See Section 01 91 13 - General Commissioning Requirements, for commissioning requirements.
- B. Test electrical grounding for compliance with requirements of authorities having jurisdiction.
- C. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.
- D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Conduct walking tour of project.
 - 3. Briefly describe function, operation, and maintenance of each component.
- E. Training:
 - 1. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide staff a complete understanding of how to utilize and properly operate all functions.
 - 2. The training program shall be implemented by a staff member/trainer employed by the system installer. The trainer must be factory certified to provide training on their product. The trainer must be a Crisis Communications Automation Specialist who will work with the Owner to help them utilize the system to support the crisis plans set by the Owner.
 - 3. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide a document listing all of the staff members who attended, received, and completed the training program.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

3.8 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION 275123

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

TABLE OF CONTENTS

DIVISION 28 - ELECTRONIC SAFETY & SECURITY SPECIFICATION

Electronic Security:

280010	GENERAL ELECTRONIC SECURITY SYSTEM REQUIREMENTS
280501	COMMON WORK RESULTS FOR ELECTRONIC SECURITY SYSTEMS
281010	CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

END OF DIVISION 28 TABLE OF CONTENTS

SECTION 280010 - GENERAL ELECTRONIC SAFETY AND SECURITY REQUIREMENTS

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 and to all following sections within Division 28.

1.2 DESCRIPTION OF WORK

- A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation, and utilities.
- B. Division 28 of these Specifications, and Drawings numbered with the prefix TY generally describe these systems, but the scope of the Electronic Safety & Security Work includes all such Work indicated in all the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing, Electrical and Telecommunications Drawings and Specifications; and Addenda.
- C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets, and cabling without showing all the exact details as to elevations, offsets, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.
- D. Specifications, along with the device schedules located on drawing legend sheets, define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.3 ABBREVIATIONS

ADA	Americans with Disabilities Act
AFF	Above Finished Floor

AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ETL	Electrical Testing Laboratories, Inc.
FCC	Federal Communications Commission
FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineers
LED	Light Emitting Diode
NEC	National Electric Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies
NRTL	Nationally Recognized Testing Laboratory
OEM	Original Equipment Manufacturer
OFCI	Owner Furnished Contractor Installed
OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories
UON	Unless Otherwise Noted

1.4 QUALITY ASSURANCE

- A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workpersons duly trained to perform the Work specified.
- B. Qualifications – refer to individual Division 28 sections for specific Personnel and Contractor Qualifications.
- C. Install all Work in strict conformance with all manufacturers' requirements and recommendations unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation.
- D. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size, and capacity. Provide all material and equipment of the same type from the same manufacturer.
- E. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

- F. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations, and requirements of the service providers serving the project and the Owner's insurance underwriter.
- G. Drawings, specifications, codes, and standards are minimum requirements. Where requirements differ, the most stringent apply.
- H. Should any change in drawings or specifications be required to comply with governing regulations, notify and receive written approval from the Architect prior to submitting bid.
- I. All equipment and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, NEC, NEMA, NFPA, OSHA, UL, and the State Fire Marshall.
- J. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced, full-time Project Manager who is authorized to make decisions on behalf of the Contractor.
- K. Warranty Requirements
 - 1. Refer to Division 1 and General Conditions for Warranties.
 - 2. Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a minimum period of 12 months from date of Substantial Completion, or longer where specific items are required to carry a longer warranty in these Construction Documents or a manufacturer's standard warranty exceeds the minimum. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 1.
 - 3. Refer to individual Division 28 sections for additional warranty requirements, as certain components and systems will have warranty requirements that exceed 12 months.
 - 4. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.
 - 5. Schedule repairs with the Owner for times of the day, days of the week as specified by the Owner. No premiums shall be charged to the Owner for work requiring weekend or after "normal business hours" access.
 - 6. Perform the remedial work within 48 hours, upon written notice from the Architect or Owner, unless deferred by the Owner.
 - 7. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.5 CODES, REFERENCES, AND STANDARDS

- A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes.
- B. Bring all perceived conflicts between codes, ordinances, rules, regulations and these documents to the Architect's and Design Consultant's attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.
 - 1. If a conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Design Consultant, without additional compensation. Contractor will be held responsible for any violation of the law.
- C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.
- D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes. Refer to individual sections for exact codes, references, and standards.

1.6 DEFINITIONS:

- A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:
 - 1. AHJ - The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
 - 2. Approved - Labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
 - 3. As Directed - As directed by the Architect, or his representative.

4. Concealed - Embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed within hung ceilings.
5. Conditionally Approved – The manufacturer has been found reputable by the design professional, but the design professional has not verified that the product offering by manufacturer meets to all specification requirements. Contractor shall adhere to submittal review process for final approval on products.
6. Design Consultant - Where referenced in this Division, "Design Consultant" is the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions.
7. Furnish - "To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations."
8. Furnished by Owner (or Owner-Furnished) or Furnished by Others: "An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division."
9. Install - "To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."
10. NRTL - Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTL's that are acceptable to the AHJ, and standards that meet the specified criteria.
11. Provide - "To furnish and install complete, and ready for the intended use."
12. Prime Contractor – a project's overall contractor responsible for all Divisions of Work, usually identified as a General Contractor or Construction Manager At Risk.
13. Submit - Submit to Architect for review.
14. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

- a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.
15. Value Engineering: A systematic method to improve the "value" of goods and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. The goal of VE is to achieve the desired function at the lowest overall cost consistent with required performance.
16. Wet Location - A location subject to saturation with water or other liquids. Pathways installed in wet locations do not protect cables from moisture such that cables installed in pathways within wet locations must be identified by their manufacturer for use in wet locations.
- a. For example: Slab-on-grade construction where pathways are installed underground or in or under concrete slabs that are in direct or indirect contact with soil (e.g., sand and gravel with or without a moisture barrier) is considered a "wet location."
17. () – Where appearing in product part or model numbers; shall represent wild card character to be filled in by the contractor to meet required specifications.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by, or acceptable to, the Design Consultant as equivalent to the item or manufacturer specified".

1.7 COORDINATION

- A. Coordinate with other Divisions for Electronic Safety and Security work to be included but not listed in Division 28 or indicated on the Security or Fire Alarm Drawings.
- B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.
- C. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Follow these drawings as closely as the actual construction and the work of other trades will permit.

- D. Maintain a project manager, as specified by the Quality Assurance sections of these specifications, on the jobsite always to coordinate this Work with other trades so that various components of the Division 28 systems are installed at the proper time, fits the available space, allows proper service access to all equipment, and meets all required codes and standards.
- E. Execute the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.
- F. Work of this Division shall progress according to the "Construction Schedule" as described in Division 1 and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule to ensure successful achievement of all schedule dates.
- G. Carefully check space requirements with other trades to ensure that equipment can be installed in the spaces allotted.
- H. Refer to Coordination requirements in specific sections for additional information.
- I. Examine and compare the Contract Drawings and Specifications with the Drawings and specifications of other trades and report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- J. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of Record Drawings.
- K. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections shall be made or which shall be changed or altered.
- L. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Architect.

1.8 MEASUREMENTS AND LAYOUTS

- A. The Drawings are schematic in nature but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.9 SUBMITTALS

- A. Refer to Division 1 and General Conditions for general submittal requirements in addition to requirements specified in this section. Refer to individual Division 28 Sections for additional submittal requirements. Unless otherwise noted, it is acceptable to submit electronic, PDF files.
- B. Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, the license agreement for transfer of information obtained from the Engineer must be used.
- C. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.
- D. Unless noted otherwise within each individual section, submittals shall be provided for approval in four distinct submittal stages:
 - 1. "Pre-bid" Submittal
 - a. Generally means submittals required no less than two weeks prior to the due date for the submission of bids, such as:
 - 1) Product substitutions approved alternate or equivalent requests to be reviewed for approval (Prior to Bid). Coordinate with Division 1.
 - 2) Alternate personnel credentials to be reviewed for approval
 - 2. " Bid" Submittal
 - a. Generally means submittals required at the time of the submission of bids, such as:
 - 1) Personnel Qualifications
 - 2) Contractor Qualifications
 - 3. " Pre-Construction" Submittal
 - a. Generally means submittals required after the award of the project to the winning bidder and prior to starting construction. At a minimum, Pre-Construction submittals shall include:
 - 1) The project name
 - 2) The submitted contractor's company name, the individual's name responsible for the submittal, and contact information for that individual

- 3) The Prime Contractor's stamp, which shall certify that the stamped submittals have been check by the Prime Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
- b. Submittals for this division shall be divided and titled in the following manner:
 - 1) Division 28 Electronic Security Systems
- c. Submit the following items within 4 weeks after the notice to proceed:
 - 1) Division of Labor amongst sub-contractors. Include:
 - a) Information on each sub-contractor:
 - i) Company Name
 - ii) Address
 - iii) Name of project manager for this project, including:
 - (1) E-mail
 - (2) Telephone number
 - b) A detailed description or matrix identifying who is responsible for furnishing, installing, and verifying the following system components:
 - i) General requirements:
 - (1) Various system power, backup power, and grounding/bonding items.
 - (2) Various conduit and other common work items.
 - (3) Various low-voltage wires/cabling and terminations.
 - (4) Various structural and seismic items (including design)
 - ii) Individual Division 28 sections
 - 2) Updated Personnel and Contractor Qualifications (resubmit if there are no changes)
 - 3) Schedule - A Gantt chart or Milestone list that includes the following timetables:
 - a) Pre-Construction Submittals

- i) Include time for resubmittals
 - ii) Unless otherwise stated elsewhere within these specifications, assume 1 week review time for the Prime Contractor and 2 weeks for the Architect/Division 28 Design Consultant for each submittal.
 - b) Material purchase/shipping schedules (to identify any long lead times for critical components)
 - c) Conduit Installation
 - d) Cabling Installation
 - e) Cabling termination and testing
 - f) Power and backup power availability
 - g) Equipment installation and testing
 - h) System startup and configuration
 - i) As-built drawings
 - j) Operation and Maintenance Manual submission, resubmission, and approval
 - k) Final Site Observation for Substantial Completion approval to be at least 2 weeks prior to overall project Substantial Completion date
 - l) Owner Training sessions
 - m) Other items as required by individual sections in this Division
- 4) Equipment List - A typed list, indexed by Specification section, of products specifically identified by part number (no wild card characters) within each specification section in this Division. Products are to be listed in the same order as in the specification. List is to include length of manufacturer warranty for each product.
- 5) Data Sheets - Manufacturers' data-sheets:
- a) At a minimum all product data-sheets shall contain the following:
 - i) The manufacturers' name and logo somewhere on the page

- ii) All parts, pieces, and equipment submitted for review shall be identified specifically by stamp or highlighted in such a manner that the product(s) being considered are clearly identifiable and distinguished from all other materials, parts or equipment that may be on the submittal.
 - iii) For data-sheets with accessories, additional parts, or derivations of the product being submitted all shall be clearly identified for the reviewer and acceptance.
 - iv) Sufficient detail for reviewer to identify all required information, such as size, weight, color, NRTL listings, approval or certification information, and other necessary identifying information to confirm product meets specifications.
 - b) Data-sheets are to be in the same sequential order as is presented within the specifications.
 - 6) Warranty Information – For warranties required by this specification and other Related Sections, submit warranty terms and conditions for each system or product. These shall contain the following:
 - a) Length of warranty period
 - b) What is covered
 - c) All disclaimers, limitations, etc.
 - d) What, if anything, is not covered
 - 7) Samples – refer to individual sections for exact sample requirements.
 - a) Samples requested shall be physical examples that represent materials, equipment or workmanship and establish standards by which the work will be judged. Contractor or Manufacturer is to cover return shipping if sample is to be returned.
 - 8) Shop Drawings – Refer to individual sections for exact Shop Drawing requirements.
- d. And as required by individual sections in this Division
4. “Project Completion” Submittal
- a. Generally means, unless otherwise noted, submittals required to be submitted 4 weeks prior to Substantial Completion, for the Design Consultant to reference during

the "Final Punch" Site Observation. Project Completion, aka "Close-out Documents" include the following:

- 1) Record Drawings
 - 2) Operation and Maintenance Manuals – refer to "Operations and Maintenance Data" section below.
 - 3) Owner training syllabus
 - 4) Recorded Owner Training
 - 5) Project test reports
 - 6) Cable Databases (as applicable)
 - 7) Warranty Certificate(s)
 - 8) And as required by individual sections within this Division
- E. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 1. Contractor shall notify the Architect and Design Consultant that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 1, Contractor shall include the website, username and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Design Consultant's designated representatives. Contractor shall allow the Design Consultant review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.
- F. Identify each sheet of printed submittal pages (using arrows, highlighting, underlining, or circling) to show applicable sizes, types, model numbers, ratings, capacities, and options being proposed. Cross out or line-through non-applicable information. Note specified features such as materials or paint finish.
- G. Provide submittals in sufficient detail to demonstrate compliance with these Contract Documents and the design concept.
- H. Transmit submittals as early as required to support the project schedule. Allow two weeks Design Consultant review time, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before construction starts.
- I. No part of the work shall be started in the shop or in the field until the shop drawings and /or samples for that portion of the work have been submitted and accepted.

- J. Before transmitting submittals and material lists, verify that the equipment submitted is compatible with and suitable for the intended use. Verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- K. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.
- L. Submittals shall contain the following information. Submittals not so identified will be returned to the Contractor without action:
 - 1. The project name
 - 2. The applicable Specification Section
 - 3. The submittal date
 - 4. The submitting contractor's company name and the project manager's name and contact information.
- M. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
- N. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, piping, and service connection data.
- O. The Design Consultant's checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Design Consultant's and Architect's attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve the Contractor from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.
- P. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.
- Q. Maintain a complete set of reviewed and stamped shop drawings and product data on site.

- R. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.

1.10 ELECTRONIC DRAWING FILES

- A. AutoCAD

- 1. In preparation of shop drawings or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of 200 for a drawing set up to 12 sheets and 15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall request and complete the Electronic File Release Agreement form from the Engineer. Send the form along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and Engineer's release agreement form must be received before electronic drawing files will be sent.

1.11 SUBSTITUTIONS

- A. Refer to Bid documents, General and Supplementary Conditions and Division 01 Specification Sections for limitations and restrictions on substitutions in addition to requirements specified in this section.
- B. For products, materials, equipment, or systems for which this Division specifically identifies, the Contractor shall use it as the basis for their bid. However, if the Contractor feels a substitute is appropriate for consideration they may submit, as required in these documents prior to bid, for approval by the Design Consultant.
- C. Materials, products, and equipment described in the Bidding Documents establish a standard of required function, performance, dimension, appearance, and quality to be met by the proposed substitution.
- D. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.
- E. Request for Substitution:
 - 1. Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.
 - 2. The burden of proof of the merit of the proposed substitution is upon the proposer.
 - 3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:

- a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
- b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
- c. Proposed substitution has received necessary approvals of authorities having jurisdiction.
- d. Same warranty will be furnished for proposed substitution as for specified Work.
- e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
- f. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

F. Substitution Consideration:

1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.
2. No substitutions will be considered with receipt of Bids unless the Architect and Design Consultant have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids and have approved the substitution request.
3. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work of related trades are not permitted.
4. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the performance as stated or implied in the Contract Documents.
5. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.12 OPERATION AND MAINTENANCE DATA

- A. Refer to Division 1 and General Conditions for Operation and Maintenance Data.

- B. Prior to Substantial Completion of the project, furnish to the Architect, for Design Consultant's review, and for the Owner's use, the following Division 28 items:
 - 1. An electronic PDF file containing:
 - a. A parts list of all equipment installed
 - b. Equipment data-sheets for all equipment installed,
 - c. Summary of all settings and configurations for each piece of installed equipment
 - d. Listing of all software and versions install
 - e. All software licensing information
 - f. Record Drawings completed in electronic format, updated from submitted Shop Drawings,
 - g. Manufacturer's service and maintenance data,
 - h. Warranty certificates
 - i. Include local contacts complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.
- C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.
- D. Refer to individual sections in this Division for additional requirements.

1.13 APPROVED EQUIVALENTS

- A. For specific products, materials, equipment, or systems for which this Division specifically identifies the Contractor shall use as the basis for their bid. Where the term approved equivalent or equal is listed the contractor may submit documentation for review by the Design Consultant for approval. The Design Consultant's acceptance or rejection is final.

1.14 RECORD DRAWINGS

- A. Refer to Division 01 and General Conditions for Record Drawings in addition to requirements specified in this section.

- B. Maintain daily a set of jobsite work prints of the Issued for Construction Drawings, reflecting an accurate dimensional record of deviations between work shown on Drawings and that installed.
 - 1. Record dimensions clearly and accurately to delineate the work as installed; suitably identify locations of all equipment by at least two dimensions to permanent structures.
 - 2. Pay particular attention to those items that require locating for servicing. This includes, but is not limited to, above-ceiling items such as:
 - a. Cable and conduit routing
 - b. Pullbox and junction box locations
- C. At the completion of the project, obtain reproducible electronic copies of the final Drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done electronically and saved to PDF format. Mark each sheet "Record Drawing", along with the date, and deliver these Record Drawings to the Architect.
 - 1. PDF versions of the drawings shall have searchable text. "Flattened" PDFs will not be acceptable.

1.15 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 1 and General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.
- B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.
- C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and always, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect and Design Consultant.
- D. Be responsible for the safe storage of tools, material, and equipment.

1.16 PROJECT CONDITIONS

A. Conditions Affecting Work In Existing Buildings:

1. The Drawings describe the general nature of remodeling to the existing building; however, visit the Site prior to submitting bid to determine the nature and extent of work involved.
2. Schedule Work in the existing building with the Owner.
3. Perform certain demolition work prior to the remodeling. Perform the demolition that involves applicable equipment, raceways, equipment supports or foundations and materials.
4. Remove articles that are not required for the new Work. Unless otherwise indicated, remove each item removed during this demolition from the premises and dispose in accordance with applicable federal, state, and local regulations.
5. Relocate and reconnect all facilities that shall be relocated to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where equipment or materials are removed, cap unused raceways below the floor line or behind the wall line to facilitate restoration of finish.
6. Obtain permission from the Architect for channeling of floors or walls not specifically noted on the Drawings.
7. Protect adjacent materials indicated to remain. For Work specific to this Division, install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
8. Locate, identify, and protect all services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services shall be interrupted, provide temporary services for affected areas.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Use only products listed for their intended use by a NRTL, except products for which no relevant standards exist.
- B. Where products are required to be NRTL listed, classified, approved or otherwise each individual item shall bear the NRTL mark by permanent means.
- C. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.

- D. Products and materials shall not contain asbestos, PCB, or any other material, which is considered hazardous by the Department of Environmental Protection or any other authority having jurisdiction.
- E. As directed by the Architect, replace materials of less than specified quality and relocate work incorrectly installed.
- F. Refer to individual sections for labeling requirements.
- G. Install materials and equipment with qualified trade people.
- H. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- I. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- J. Where factory testing of equipment is required to ascertain performance and attendance by the Owner's representative is required to witness such tests, associated travel costs and subsistence shall be paid for by the Contractor.
- K. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be de-rated with the method of de-rating identified on the submittals.
- L. Enclosures for Electronic Safety and Security Infrastructure/equipment installed in mechanical equipment rooms shall be NEMA type 1 gasketed. Enclosures for Electronic Safety and Security Infrastructure/equipment installed outdoors shall be NEMA type 3R.
- M. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of product data submittal.
- N. Ship and store all products and materials in a manner that will protect them from damage, weather, and entry of debris. If items are damaged, do not install, but take immediate steps to obtain a replacement. Repairs of damaged goods will only be permitted with prior written permission of the Owner/Design Consultant.
- O. Part numbers and product codes in these specifications are correct as of the time of writing. Manufacturers may, however, change part numbers and product codes on short notice. In cases where part numbers or product codes differ from technical specifications for a particular product, provide products meeting the minimum technical specifications of the products in the specifications. Notify the Owner/Design Consultant of any product code and or part number changes on the material list submittal.

PART 3 - EXECUTION

3.1 FEES AND PERMITS

- A. Secure and Pay all required fees and obtain all required permits related to the Electronic Safety and Security Systems' installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.

3.2 SELECTIVE DEMOLITION

- A. Refer to Division 1, Division 2, and General Conditions for Selective Demolition requirements in addition to the requirements specified herein.
- B. Examine the site to observe existing conditions before submitting a bid.
- C. General: Demolish, remove, demount, and disconnect abandoned communications materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- D. Schedule demolition in advance. Schedule work to avoid disruption of normal operations.
- E. Materials and Equipment to Be Salvaged:
 - 1. Electronic Safety and Security infrastructure and equipment to be removed that is in good working order shall be carefully removed and offered to the Owner. Items rejected by the Owner shall be removed from the project site and legally and properly disposed of.
 - 2. Remove, demount, and disconnect existing communications materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- F. Reconnect circuits serving equipment required to remain in service to other cable termination fields, patch panels or splices as indicated on the Drawings or as appropriate. Provide additional cable and termination hardware where there is insufficient available capacity in remaining existing equipment for reconnection.
- G. Remove existing conduit and wire back to the Electronic Safety and Security Equipment unless a specific extent of removal is indicated on the Drawings.
- H. Electronic Safety and Security Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete raceways, fittings, supports and specialties, equipment, wiring, controls, fixtures, and insulation:
 - a. Raceways and outlets embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Cut embedded raceways to below

finished surfaces, seal, and refinish surfaces as specified or as indicated on the Architectural finish Drawings. Remove materials above accessible ceilings. Cap raceways allowed to remain.

- b. Perform cutting and patching required for demolition in accordance with Division 1, General Conditions and "Cutting and Patching" portion of this Section in Division 28.

3.3 EXISTING CONDITIONS

- A. Existing conditions indicated on the Drawings are taken from the best information available from the Owner, existing record drawings, and from limited, in-situ, visual site observations; and they are not to be construed as "AS BUILT" conditions. The information is shown to help establish the extent of the new Work.
- B. Verify all actual existing conditions at the project site and perform the Work as required to meet the existing conditions and the intent of the Work indicated.

3.4 EXISTING SERVICES

- A. Existing Electronic Safety and Security Infrastructure services not specifically indicated to be removed or altered shall remain as they presently exist.
- B. Where existing services interfere with new construction, alter, or reroute such existing equipment to facilitate new construction after obtaining written permission from the Architect. Notify in writing giving two weeks advance notice or planned alteration prior to altering any existing condition is required.
- C. Schedule and coordinate with the Owner and with the Architect all connections to, relocation of, or discontinuation of normal services from any existing service provider line. Include all premium time required for all such work in the Bid.
- D. Preserve continuity of service of existing facilities (related to damage or alteration due to new construction). Unauthorized alteration to existing equipment shall be corrected without additional cost to the Owner.
- E. Repair all existing utilities damaged due to construction operations to the satisfaction of the Owner or Utility Company without additional cost.
- F. Do not leave services disconnected at the end of a workday or over a weekend unless authorized by representatives of the Owner or Architect.
- G. Make repairs and restoration of services before workmen leave the project at the end of the workday in which the interruption takes place.

- H. Include in Bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.

3.5 EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical, electrical, communications, and Electronic Safety and Security installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.6 WORK IN EXISTING FACILITIES

- A. The Drawings describe the general nature of remodeling to the existing facilities; however, visit the Site prior to submitting a Bid, to determine the nature and extent of Work involved.
- B. Schedule Work in the existing facility with the Owner.
- C. Certain demolition work shall be performed prior to the remodeling. Perform the demolition that involves Communications systems, fixtures, conduit, wiring, equipment, equipment supports or foundations and materials.
- D. Remove all these articles that are not required for the new Work. Unless otherwise indicated, each item removed during this demolition shall be removed from the premises and disposed of in accordance with all state and local regulations.
- E. Channel walls and floors as required to produce the desired result; however, obtain permission from the Architect or Owner for all channeling not specifically noted on the Drawings.

3.7 CLEANING

- A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.
- B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises vacuum clean. Clean all material and equipment installed under this Division.

- C. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.
- D. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.
- E. Touch up and restore damaged finishes to their original condition.
- F. All Electronic Safety and Security infrastructure and equipment shall be thoroughly vacuumed and wiped clean prior to startup and at the completion of the project. Equipment shall be opened for observation by the Architect as required.

3.8 DELIVERY, DRAYAGE AND HAULING

- A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required and provide proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.
- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, then Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.9 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost to the Owner.
- B. Take responsibility for work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment to moisture damage in dry, heated spaces.
- C. Provide adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.

3.10 CONNECTED PRODUCTS CYBER- SECURITY

A. Software Requirements

1. All firmware in products furnished or provided by the Contractor shall be the latest and most up-to-date provided by the manufacturer.
2. All equipment requiring users to log on using a password shall be configured with user/site-specific passwords). No system/product default passwords shall be allowed. Coordinate user logins and passwords with Owner prior to system setup.
 - a. Passwords shall always be guarded and protected, including during construction phase of the project. Passwords shall not be written on or in any device, enclosure, or room where access could be obtained by others.
 - b. Passwords shall be transmitted to owner, and Design Consultants via secure methods, obscuring or encrypting the document to be transmitted. This document shall be secured while stored for submission with the project(s) other submittals, including Shop Drawings and As-Built documentation.
3. Refer to individual sections for additional software requirements.

B. Network and Cybersecurity Requirements

1. For all Electronic Security Systems that have Contractor-provided equipment with an Ethernet/LAN port, Contractor shall coordinate with Owner's IT staff regarding Owner's network and cyber security requirements.
2. The Contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owner's technology infrastructure and network. These measures shall include but are not limited to:
 - a. Coordinate with the manufacturer to ensure newly procured equipment does not have any cybersecurity notices, bulletins, or alerts. Provide a letter to the Design Consultant with the submittal documents for that Specification section confirming there are no active or known cyber threats.
 - b. Ensure all installers/technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics.
 - c. The Contractor shall assess any cyber threats / vulnerabilities associated with the specified equipment, prior to procurement/installation. If cyberthreats are discovered, notify the Design Consultant within one Day. Provide the make and model of the associated equipment and the vulnerability.

- d. Follow additional cybersecurity requirements and procedures as directed by the Owner's IT staff.
- C. Refer to individual sections for additional Networking and Cybersecurity Requirements.

3.11 ADJUSTING, ALIGNING AND TESTING

- A. Adjust, align, and test all Electronic Safety and Security infrastructure and equipment furnished and/or installed under this Division.
- B. Check and test protective devices for specified and required application and adjust as required.
- C. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.
- D. Notify the Architect immediately of all operational failures caused by defective material, labor, or both.
- E. Refer to individual Sections for additional and specific requirements.

3.12 START-UP OF SYSTEMS

- A. Prior to start-up of Electronic Safety and Security systems, check all components and devices, to confirm compliance with manufacturers' recommended installation procedures.
- B. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.
- C. Refer to individual Sections for additional and specific requirements.

3.13 OPERATING INSTRUCTIONS

- A. Instruct Owner's operating and maintenance personnel in proper starting sequences, operation, shutdown, general maintenance, and preventative maintenance procedures, including normal and emergency procedures.
- B. Refer to individual Sections for additional and specific requirements.

3.14 SUBSTANTIAL COMPLETION REVIEW

- A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:

1. Submit complete Operation and Maintenance Data.
 2. Submit complete Record Drawings.
 3. Perform all required training of Owner's personnel.
 4. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
 5. Perform start-up tests of all systems.
 6. Remove all temporary facilities from the site.
 7. Comply with all requirements for Substantial Completion in the Division 1 and General Conditions.
- B. Request in writing a review for Substantial Completion. Give the Architect at least seven (7) days' notice prior to the review.
- C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.
- D. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.
- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, then provide reimbursement to the Architect and Design Consultant for time and expenses incurred for the visit.
- F. Upon completion of the review, the Architect and Design Consultant will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.
- G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.
- H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.
- 3.15 EARLY OCCUPANCY
- A. Failure to meet the Substantial Completion date can result in the Owner needing to take early occupancy. Complete the systems which are necessary to allow partial early occupancy of the building by original Substantial Completion date.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

1. Refer to individual sections for additional requirements.
- B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

END OF SECTION

SUBSTITUTION REQUEST FORM

To Project Engineer: _____ Request # (GC Determined): _____

Project Name: _____

Project No/Phase: _____ Date: _____

Specification Title: _____

Section Number: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Model No.: _____

Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified Work: _____

☐ Point-by-point comparative data attached – REQUIRED BY ENGINEER

Comparative data may include but not be limited to performance, certifications, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements. Include all information necessary for an evaluation.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples
☐ Tests ☐ Reports ☐ Other: _____

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain: _____

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

Substitution Certification Statement:

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner that the:

- ▲ A. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
- B. Proposed substitution is consistent with the Contract Documents and will produce indicated results.
- C. Proposed substitution does not affect dimensions and functional clearances.
- D. Proposed substitution has received necessary approvals of authorities having jurisdiction.
- E. Same warranty will be furnished for proposed substitution as for specified Work.
- F. Same maintenance service and source of replacement parts, as applicable, is available.
- G. Proposed substitution will not adversely affect other trades or delay construction schedule.
- H. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

_____ Submitting Contractor	_____ Date	_____ Company
--------------------------------	---------------	------------------

Manufacturer's Certification of Equal Quality:

I _____ represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to Architect, Engineer, and Owner that the function and quality of the Proposed Substitution meets or exceeds the Specified Item.

_____ Manufacturer's Representative	_____ Date	_____ Company
--	---------------	------------------

Engineer Review and Recommendation Section

Recommend Acceptance ☐ Yes ☐ No
Additional Comments: ☐ Attached ☐ None

Acceptance Section:

_____ Contractor Acceptance Signature	_____ Date	_____ Company
_____ Owner Acceptance Signature	_____ Date	_____ Company
_____ Architect Acceptance Signature	_____ Date	_____ Company
_____ Engineer Acceptance Signature	_____ Date	_____ Company

SECTION 280501 - COMMON WORK RESULTS FOR ELECTRONIC SECURITY

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. This Section includes general construction materials and methods, electronic security equipment coordination, and common Electronic Security Systems installation requirements as follows:
 - 1. Pathways
 - a. Conduit
 - b. Outlet Boxes
 - c. Pull Boxes
 - 2. Grounding and Bonding
 - 3. Firestopping Systems
 - 4. Access Panels
 - 5. Identification
- B. *Note* Refer to Division 28 Section "Common Work Results for Fire Alarm Systems" for common work requirements for fire alarm systems. This section specifies the common work requirements of all other Division 28 sections.

1.2 RELATED SECTIONS

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Division 28 Section "General Electronic Safety and Security Requirements"
- B. Firestopping requirements listed in this section are unique to Division 28 Work. Refer to Division 07 Section "Penetration Firestopping" for general and additional firestopping requirements.
- C. Refer to Division 26 for materials and methods for additional requirements for the following:
 - 1. Division 26 Section "Common Work Results for Electrical" for electrical systems coordination.

2. Division 26 Section "Equipment Wiring Systems" for electrical systems coordination.
3. Division 26 Section "Grounding and Bonding for electrical systems" for electrical systems coordination.
4. Division 26 Section "Hangers and Supports for Electrical Systems" for electrical systems coordination.
5. Division 26 Section "Raceways and Boxes for Electrical System" for electrical systems coordination.
6. Division 26 Section "Cable Tray" electrical systems coordination.
7. Division 26 Section "Underfloor Raceways for Electrical Systems" electrical systems coordination.
8. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for electrical systems coordination.

1.3 CODES, STANDARDS, AND GUIDELINES

- A. Follow all applicable codes, references, and standards listed in Division 28 Section "General Electronic Safety and Security Requirements".
- B. Follow all guidelines listed in Division 28 Section "General Electronic Safety and Security Requirements".
- C. Follow the correct revision or printing (UON) of all applicable codes, references, standards, and guidelines.
- D. Follow the additional codes, references, standards, and guidelines:
 1. Follow the additional codes, references, standards, and guidelines:
 - a. For Telecommunications Infrastructure (Category 5e/6/6A and fiber optic cabling) required by this division:
 - 1) ANSI/TIA/EIA-569-C – "Commercial Building Standard for Telecommunications Pathways and Spaces"
 - b. For Firestopping installed by this division:
 - 1) ASTM E 814 and ANSI/UL1479 – "Fire Tests Through Penetration Firestops"

- 2) ASTM E 84 and ANSI/UL 723 "Surface Burning Characteristics of Building Materials"
- 3) ASTM E 119 and ANSI/UL 263 "Fire Tests of Building Construction Materials"

1.4 QUALITY ASSURANCE

- A. Install all Work in strict conformance with all manufacturers' requirements and recommendations unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.
- B. Firestopping Systems
 1. Firestopping material and systems shall be tested and listed by UL. All firestopping products shall bear this classification marking.
 2. Installation technicians shall be by qualified and trained personnel. Acceptable installer qualifications are as follows:
 - a. FM Research approved in accordance with FM AS 4991.
 - b. Individuals who are trained and certified by the firestopping manufacturer. For Specified Technologies, all installers shall have current FIT Level 1 certification.

1.5 SUBMITTALS

- A. Follow the requirements for submittals in Division 28 Section "General Electronic Safety and Security Requirements".
- B. The following submittals are due as part of the Pre-Bid Submittal:
 1. For all products for which a substitute is to be considered as an approved equivalent or acceptable substitution, provide submittals with sufficient detail for review by the Design Consultant. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information. Be prepared to submit a sample should the Design Consultant request an evaluation.
- C. The following submittals are due at the Pre-Construction Submittal:
 1. Contractor Qualifications (for Firestopping Systems): Provide copies of training/certification as required in the Quality Assurance portion of this specification section.

2. Parts List: Provide a typed list indicating part name, manufacturer, part number, and color (if applicable) for products specifically identified herein by the exact and complete part number (no wild-card characters).
3. Submit manufacturers' cut sheets or catalog cut sheets of each of the pathways not specifically identified by its exact part number:
 - a. Cut sheets shall include the following information at a minimum:
 - 1) Manufacturers name and logo
 - 2) Size – including physical and loading dimensions
 - 3) Maximum span length
 - 4) Weight supported
 - 5) Type
 - 6) Fittings to be used
 - 7) Method of attachment to structure
 - 8) Firestop system assembly information for each system to be installed:
 - a) Documentation from UL catalog for each system proposed. This documentation shall include the following information:
 - i) Firestop manufacturer
 - ii) UL system number
 - iii) F, T, and L Ratings
 - iv) The complete description of the firestop system; To include what specific construction the system is intended to pass through such as a wall or floor assembly, the penetrating items allowed to pass through the opening in the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings.
4. Shop Drawings:
 - a. Submit for review scaled layout drawings showing the size/routing of all pathways and the size/information/locations of all boxes, pullboxes, firestopping systems, and access panels.

- 1) Each pathway shall be identified by type and size on the drawings.
 - a) Example #1: 4" EMT
 - b) Example #2: 2" IMC
- 2) Each grounding conductor shall be identified by size (and insulation):
 - a) Example: #3/0 insulated ground
- 3) Each firestop system shall be identified by Manufacturer and Product, as well as UL system number for that location.
 - a) Example #1 – Firestopping Sleeve: EZ-Path Series 22, UL System W-L-3255
 - b) Example #2 – Backbox in Fire-Rated Wall: Specseal Power Shield, UL System QCSN/CLIV.R14288
- 4) Each pullbox and access panel shall be identified by size and height above finished floor.
 - a) Pullbox Example: Pullbox 8" x 24" x 40" approximately 12' AFF.
- b. Include pathway systems (conduit, cable tray, auxiliary supports, etc.) and other common work on the same shop drawings for Division 28 "Electronic Security Systems".
 - 1) The following submittals are due at the Project Completion Submittal:
 - a) Record Drawings:
 - i) Based on the work prints kept on the jobsite and official changes to the Contract Documents (such as Change Orders, Architect's Supplemental Instructions, and Design Change Directives), create final drawings incorporating any minor and approved changes to the submitted Shop Drawings. Submit this set in accordance with the Record Drawings requirements of Division 28 Section "General Electronic Safety and Security Requirements".
 - b) Keys – Supply two copies of every key as required for pullboxes, junction boxes, and access panels.

1.6 DEFINITIONS

- A. Conditionally Approved - the manufacturer has been found reputable by the Design Consultant, but the Design Consultant has not verified that the product offering by manufacturer meets to all specification and project requirements. Contractor shall adhere to submittal review process for final approval on products.
- B. Conveniently Accessible – Capable of being reached from the floor or via the use of a 6 to 12 footstep ladder without crawling or climbing over or under obstacles such as piping, duct work, motors, transformers, pumps, etc.
- C. Firestopping System – Firestopping products that have been specifically tested and rated by a Nationally Recognized Testing Laboratory (NRTL), such as UL, to provide the required flame (F), fire and temperature (T), air and smoke (L), and water (W) containment for a given partition/penetration.
- D. Ground or Grounding – A conducting connection, whether intentional or accidental, between an electrical circuit (e.g. telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.
- E. IMC – Intermediate Metal Conduit
- F. Plenum – A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
- G. Plenum-rated – A product that is listed by a NRTL as being suitable for installation into a plenum space.
- H. RMC – Rigid Metal Conduit
- I. Surface Metal Raceway – A metallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.
- J. Surface Nonmetallic Raceway – A nonmetallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.
- K. UL – Underwriters Laboratory

1.7 COORDINATION

- A. Coordinate arrangement, mounting, and support of equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping, ducts, and other systems installed at required slopes and/or elevations.
 4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.
 5. Adjust location of conduits, terminal blocks, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
 - a. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
 - b. Provide offsets, transitions, and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines. Refer to Part 3 of this section for stringent conduit bend requirements.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for Division 28 equipment that are behind finished surfaces or otherwise concealed.
- D. Coordinate testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS AND MATERIALS

2.1 PATHWAYS FOR ELECTRONIC SECURITY SYSTEMS

- A. General
1. Category 6 and fiber cabling and pathways between Equipment Rooms (shared Communications Rooms) and devices are by Division 27.
 2. All other cabling serving Electronic Security System devices within the footprint of the building shall meet the following requirements (from device to Equipment Room):

- a. For areas above accessible ceilings, supported via J-hooks every 48"-60" back to nearest cable tray or serving Equipment Room. For inaccessible ceilings or ceilings exposed to structure, continue routing cable within conduit.
3. Division 28 "Electronic Security Systems" Contractor is to indicate proposed pathway types/supports and routing on Division 281000 Shop Drawings.

B. Conduit

1. Specifications

- a. Refer to Electrical Division 26 for specific product and material information.
 - 1) Conduits routed within the building as connection to outside devices (exterior to the footprint of the building) shall be rigid metal (RMC) or intermediate metal conduit (IMC) at the point it enters the building, emerges from an exterior wall or ground floor slab to the final Equipment Room termination/transition point.
 - 2) If services enter a room or space such as a mechanical room, electrical room or other intermediate room due to convenience or proximity to the exterior and adequate space has not been provided within 50 feet for the equipment needed for transitioning these and future cables/services to an appropriately rated indoor cable then those conduits shall be continued uninterrupted (except for necessary pull boxes) to the final connection point or location where the transition point has been designated.
- b. For interior devices (and devices on the face of exterior walls) Electrical metallic tubing (EMT) with compression connectors shall be used where concealed in walls, above ceiling, and exposed or concealed in equipment rooms.
- c. Unless specifically identified on the Security drawings, flexible conduit shall not be used.
- d. Conduits shall be dedicated to specific sub-systems (i.e. video cabling shall not be installed in any other sub-system conduit, such as access control, intrusion detection, fire alarm, etc.).
- e. Provide conduit as indicated on the Drawings or required by this Specification.
 - 1) Minimum conduit size for all Category 6 cabling shall be: □" inch for interior locations and 1" for exterior locations (such as devices at light poles and gates).
 - 2) Provide a polypropylene or monofilament plastic line with not less than 200-lb tensile strength in each conduit.

- 3) Permanently mark or tag each conduit at the source and inside each pull box, identifying it based on specific subsystem (Access Control, Intrusion Detection, etc) and far-end destination. Each conduit that is stubbed into the ceiling space from an outlet box shall be permanently marked or tagged; refer to Labeling requirements in Section 3 – Execution.

C. Outlet Boxes

1. The following manufacturers are Conditionally Approved, unless otherwise noted.
 - a. Emerson/Appleton
 - b. Hubbell/RACO
 - c. Randl Industries
 - d. Thomas & Betts/Steel City
 - e. Or Approved Substitution (submitted and accepted in the “pre-bid” phase)
2. Specifications
 - a. Boxes shall either be square or rectangular, as noted on the drawings. Dimensions indicate minimum size.
 - b. For masonry (CMU) walls, backbox shall be 3-1/2 inches deep. Manufacturer shall be:
 - 1) Single gang – RACO 695R, no substitutes
 - 2) Double gang – RACO 696R, no substitutes
 - c. For stud walls, backbox shall be 2-3/4 inches deep. Manufacturer shall be:
 - 1) Single gang – RACO 560 series, or equivalent from Conditionally approved manufacturer.
 - d. Telecommunications Boxes for Security – for camera outlets shown on TY drawings:
 - 1) For stud walls: dual-gang outlet box shall be a minimum size of 4-11/16 inches width by 4-11/16 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension as needed for flush mounting. Depth shall match that of wall gypsum board(s).

- a) Double gang – RACO 258/259 (Coordinate knock-out size with conduit size indicated on drawings), RANDL T-55017 or equivalent with appropriate
- 2) For ceilings (flush or above accessible ceiling): plenum-rated, dual-gang outlet box shall be a minimum size of 4 inches width by 4 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension ring as needed for flush mounting. Depth shall match thickness of gypsum ceiling board(s) or accessible ceiling panel (if applicable).
 - a) Double gang – RACO 239 or equivalent, with ceiling grid framing where installed in accessible ceiling.
- e. Junction Box – in accessible ceiling space above access controlled doors
 - 1) Minimum Size 6" x 6" x 4" deep, or as noted on drawings/details, with hinged cover
 - 2) NEMA 1 rating
 - 3) Manufacturer shall be Hoffman A6N64 (or larger) or equivalent from Conditionally approved manufacturer.
- f. Pull Boxes - for interior use only, mounted in Conveniently Accessible Locations.
 - 1) Specifications
 - a) NEMA 1
 - b) Refer to Execution section for sizing requirements.
 - 2) The following manufacturers are Conditionally Approved.
 - a) Hoffman
 - b) NEMA Enclosures
 - c) Wiegmann
 - d) Or Equivalent

2.2 GROUNDING AND BONDING

- A. Refer to drawings and Division 28 Section "Equipment Room Fittings for Electronic Security" for exact grounding and bonding requirements.

2.3 FIRESTOPPING SYSTEMS

A. General

1. The following manufacturers are Conditionally Approved.
 - a. 3M
 - b. Hilti
 - c. Specified Technologies, Inc
2. Division 28 "Electronic Security Systems" Contractor is to indicate proposed Firestopping locations that correspond to their proposed pathway and cable routing on Division 281000 Shop Drawings.
3. Refer to Architecture / Life Safety plans for locations of fire- and smoke-rated walls.

B. Zero-Maintenance Fire-Rated Pathway Device – for sleeves through a single penetration (wall or floor)

1. Specifications
 - a. Minimum performance requirements: Shall meet testing requirements of ASTM E-814 or U.L. 1479; Shall be installed in accordance with the NRTL. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer's instructions.
 - b. Shall meet or exceed the ratings of the wall or floor that it penetrates.
 - c. Shall be a pre-fabricated and zero-maintenance solution which requires no action to activate the fire and smoke protective characteristics of the device.
 - d. Allows the installation and removal of cables without the need to remove or add any materials.
 - e. Used to seal penetrations of cables through fire rated partitions
2. Manufacturer shall be:
 - a. EZ-Path family of products by Specified Technologies Inc.
 - b. SpeedSleeve series of products by Hilti
 - c. Or approved equivalent

C. Firestopping for Backboxes in Fire-Rated Walls

1. Specifications
 - a. Used to seal backboxes in fire rated partitions.
 - b. Minimum performance requirements: Shall meet UL testing requirements of UL 263 and classified as Wall Opening Protective Material (QCSN or CLIV); Shall be installed in accordance with the NRTL. Shall meet or exceed the ratings of the wall or floor that it is located in.
 - c. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer's instructions.
2. Manufacturer shall be:
 - a. Specified Technologies Inc., SpecSeal Power Shield
 - b. Or approved equivalent

D. Firestopping for Thru-Wall (or Floor) Conduit Penetrations and Other Applications

1. For fire-rated penetrations where the pathway extends beyond a single fire-rated partition, and other required firestopping applications not previously addressed in this specification.
2. Specifications:
 - a. Shall be UL listed for the specific application; Shall meet or exceed the ratings of the wall or floor that it penetrates.
3. Manufacturer shall be:
 - a. Specified Technologies Inc.
 - b. Or approved equivalent

2.4 ACCESS PANELS

A. The following manufacturers are Conditionally Approved.

- | | | |
|----|-------------------------|--|
| 1. | Activar/J. L Industries | www.activarcpg.com |
| 2. | Acudor Products | www.acudor.com |
| 3. | Alfab/Barco | www.alfabinc.com |
| 4. | Elmdor Products | www.elmdorproducts.com |

5. Karp Associates, Inc. www.karpinc.com
6. Milcor www.commercialproductsgroup.com
7. Nystrom Building Products www.nystrom.com
8. Williams Brothers www.wbdoors.com
9. Wind-lock www.wind-lock.com
10. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

B. Specifications:

1. To be utilized for access to a Pull Box that is installed above an inaccessible ceiling (where a Pull Box is required to keep the quantity of bends in conduit to 180 degrees or less between pull points).
2. Steel Access Panels and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation.
3. Joints and seams: continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
4. Frames: 16-gauge steel, with a 1 inch (25.4 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling:
 - a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
 - b. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
 - c. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
5. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
6. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

C. Locking Devices:

1. Wherever these are in a publicly accessible space and are less than 9' AFF, provide a lock.
2. Lock shall be 5-pin or 5-disc type cylinder locks, individually keyed.

3. Provide 2 keys.

- D. Indicate proposed size and locations on pre-construction shop drawings. No access panels shall be installed without Architect and Design Consultant approval.

2.5 FASTENINGS

- A. Except in equipment rooms, all exposed securing screws shall be stainless steel, center pin torx security screws. Security Fasteners: A maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Holo-Krome; a Danaher Corporation.
2. Safety Socket Screw Corporation.
3. Tamper-Pruf Screws, Inc.
4. Textron Inc.

2.6 IDENTIFICATION FOR COMMON WORK FOR ELECTRONIC SECURITY SYSTEMS

- A. Labels

1. The following manufacturers are Conditionally Approved for generic labeling requirements for conduits, pullboxes, and equipment racks.

- a. Brady www.bradycorp.com
- b. Brother www.brother-usa.com
- c. Dymo www.dymo.com
- d. HellermannTyton www.hellermannityton.com
- e. Panduit www.panduit.com
- f. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

2. Specifications:

- a. Refer to additional requirements in Part 3 – Execution.

- b. Refer to individual sections for additional identification requirements for specific work.

PART 3 - EXECUTION

3.1 PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

A. General

1. Refer to Electrical Division 26 for specific installation requirements.
 - a. Sizes, methods, and more stringent requirements shall be adhered to when specified in this Division.
2. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
3. All supports shall be specifically designed to support the required cable weight and volume. Field manufactured supports will not be accepted.
4. Install a pull cord in each pathway (empty or not) for installation of new wires or cables. Use polypropylene or monofilament plastic line with not less than 200 lb. (90.7 kg) tensile strength. Leave at least 12 inches (304.8 mm) of slack at each end of pull cord.
5. Unless otherwise noted, pathway routing shown on the Drawings is illustrative only and meant to indicate the general configuration of the work. Install pathways so that adequate clearances and offsets between pathways and other trades are provided. Coordinate all pathways with other trades prior to installation.
6. All pathways shall include empty space for a minimum of 25% growth beyond initial installation of cabling.
7. Cables shall be rigidly supported by cable pathways as indicated on the drawings. Cables shall be physically supported at intervals not to exceed 5 feet (1.52 m).
8. Store and keep dry all products in original container in a climate controlled environment until installation is to occur
9. Install all pathways:
 - a. So that cables can be pulled in accordance with referenced standards and guidelines.
 - b. So that cables can be pulled without damage to conductors, shield, armor, or jacket.

- c. So that cables are not forced or allowed to exceed minimum allowed bend radius by manufacturer or referenced standards and guidelines.
 - d. So that the maximum allowable pulling tension is not exceeded.
 - e. To meet the requirements of the structure and the requirements of all other Work on the Project
 - f. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.
 - g. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Architect.
 - h. Parallel or perpendicular to building lines or column lines.
 - i. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
10. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or other methods shall not be used to attach cables to cable supports.
11. Provide adequate pathways so that cabling is not forced to attach, be supported, or use other pathways not specifically designed and provided for. Any deviation from this will not be accepted.
- a. At no point shall cables meet, be supported by, or attach to other trades equipment or supports.
 - b. At no point shall cables meet, be supported by, or attach to building structures or supports.
12. Provide appropriately sized sleeves where cables (supported by J-hooks) are required to pass through non-rated full-height partitions. Where allowed, sleeves shall extend a minimum of 3 inches beyond the partition surface on both sides and shall be rigidly supported to support the weight of cables. Sleeves shall be sized so that no more than 40% of the cross-sectional area is utilized by the cabling to be installed.
13. Suspended cables shall be installed with at least 3 inches of clear vertical space above the ceiling tiles and support channels (T-bars).
14. Waterproofing

- a. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- b. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.

15. Cutting and Patching

- a. Where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc. using skilled tradespeople of the trades required at no additional cost to the Owner.
- b. Do not cut, channel, chase or drill masonry, tile, etc., unless permission from the Architect is obtained. If permission is granted, perform this work in a manner acceptable to the Architect.
- c. Patch around all openings to match adjacent construction.
- d. Where conduit or equipment is mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- e. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.
- f. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

16. Mounting Heights

- a. Mounting heights for equipment and devices requiring operational access shall conform to ADA requirements.
- b. Wall mounted devices requiring operational access shall be mounted a minimum of 15 inches above finished floor to bottom of device and a maximum of 48 inches above finished floor to top of device.
- c. Mounting heights shall be from floor to center of device, unless otherwise noted. Verify exact locations and mounting heights with the Architect before installation.

- d. Typical mounting heights shall match nearest adjacent typical electrical outlet mounting height UON or as directed by the Architect.

17. Painting

- a. Refer to Division 9 Section "Painting" for painting requirements.
- b. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under Division 9 of the Specifications; colors shall be as selected by the Architect.
 - 1) If painting happens after cabling has been installed, cabling shall be masked off or otherwise protected so that cables are not painted. Paint on cables degrades the cable over time. PAINTED CABLES SHALL BE REPLACED with no additional cost to the owner.
- c. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer's instructions for pre-cleaning surfaces and application.
- d. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.
- e. Where factory finishes are provided and no additional field painting is specified, touch-up or refinish, as required by, and to the acceptance of, the Architect and Design Consultant, marred or damaged surfaces to leave a smooth, uniform finish. If, in the opinion of the Architect or Design Consultant, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.
- f. Provide touch-up paint as required by Specification Sections in this Division.

18. Fastenings

- a. Fasten equipment to building structure in accordance with the best industry practice.
- b. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.
- c. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

- 1) To Wood: Fasten with lag screws or through bolts.
 - 2) To New Concrete: Bolt to concrete inserts.
 - 3) To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4) To Existing Concrete: Expansion anchor fasteners.
 - 5) To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 6) To Light Steel: Sheet metal screws.
 - 7) Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- d. Where weight applied to building attachment points exceeds 300 pounds, coordinate with, and obtain the approval of Architect and conform to the following as a minimum:
- 1) Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- e. For items, which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- f. Areas identified as noise critical spaces shall have all penetrations sealed to minimize sound transmission between adjacent spaces.
- B. Access to pathways and associated equipment
1. Locate all pull boxes, junction boxes and fire-rated pathway devices to provide easy access for operation, service inspection and maintenance.
 2. Provide an access door/panel where equipment or devices are located above inaccessible ceilings. Where access doors/panels are necessary but not shown on the plans, coordinate type and location with Architect and Design Consultant through an RFI.
 3. Maintain all code required clearances and clearances required by manufacturers.
- C. Cable Distribution

1. For low-voltage cabling (that provides power at 70v or less), refer to section 2.1 above.

D. Conduits

1. Conduit shall be of the appropriate type required by code and as required by Electrical Division 26.
2. Adequate access shall be available where cables enter conduits
3. Bond and ground all metallic conduits and boxes in accordance with national or local requirements (ANSI STD-607 – “Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications).
4. Install conduits in the most direct route possible, running parallel to building lines
5. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
6. Conduits which enter Telecommunications or Security/Equipment rooms shall extend 3 inches AFF or through the wall.
7. Flexible conduits may only be used where specifically allowed by these contract documents.
 - a. Where indicated, flexible conduit sections shall be less than 20 feet in length.
8. No continuous section of a conduit may exceed 100 feet without a Pull Box.
9. No more than (2) 90 bends, or equivalent will be allowed between Pull Boxes.
 - a. Each and any offset shall be considered a 90 bend.
 - b. A Pull Box is required wherever a reverse bend is installed.
10. The minimum bend radius for conduits is:
 - a. (6) times the inside diameter for 2 inches conduits or less.
 - b. (10) times the inside diameter for conduits greater than 2 inches.
11. Conduits shall contain no electrical condulets (also known as LBs).
12. Underground Conduit Requirements
 - a. Cabling and pathways serving devices exterior to the building, such as emergency phones/towers and security cameras.

b. Requirements

- 1) Refer to applicable details on drawings for illustrative requirements.
- 2) Route all underground conduit so there is no more than (3) 90 degree bends, including stub-up bend at communications room/equipment cabinet.
 - a) For underground conduit serving outlets/boxes outside the footprint of the building that require more than (3) 90 degree bends, provide appropriately-sized handhole(s). Coordinate location with Architect and Owner, indicate proposed location(s) on shop drawings, and include product information in pre-construction submittals. In general, handholes are NOT to be in roadways, parking lots, sidewalks, or any location that may be subject to vehicular traffic.
 - b) These underground conduits shall stub directly into the serving Communications Room/Equipment Room. If not, extend cabling within the building in IMC or RMC to the serving Equipment Room.
- 3) Approved conduit types:
 - a) When routed below slab-on-grade or outside the footprint of the building:
 - i) Horizontal conduit shall be RMC or Schedule 40 PVC a minimum of 12" below grade. If PVC is installed, also install tracer wire.
 - ii) All vertical and horizontal bends and areas subject to vehicular traffic (loads) such as parking lots and roadways shall be RMC or concrete-encased PVC.

E. Outlet boxes

1. No outlet boxes shall be located back-to-back in a wall cavity.
 - a. Where possible offset to next stud cavity, with a minimum of 6 inch separation.
2. Outlet boxes located in fire-rated walls are to have the appropriate firestopping for backboxes. These locations are to be identified on shop drawings.
3. Where cabling enters a backbox directly (not via conduit), provide black rubber grommet on knockout.

F. Pull Boxes

1. Pull Boxes shall be placed in Conveniently Accessible locations.

2. Coordinate the location and installation of all Pull Boxes to ensure adequate access is provided.
3. Pull Boxes above an accessible ceiling shall:
 - a. Be aligned directly over the ceiling grid to allow access
 - b. Be installed with a minimum of 3 inches (76.2 mm) clearance to ceiling grid and tiles
4. No directional changes shall be allowed in Pull Boxes. Conduit shall continue in the same direction as it enters and then change direction via an appropriately sized bend in the conduit.
5. Size Pull Boxes according to the following chart:

TABLE 1: Pull Box Sizing

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit (of same size)
¾" or smaller	4"	4"	2-1/8"	Not applicable
1"	4"	16"	3"	2"
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

3.2 LABELING

A. Labeling Installation

1. Labels are to be secured by adhesive. They shall have a type of adhesive that is appropriate for the surface upon which the label is to be installed. The mounting surface shall be free of dust, dirt, oil, etc. that would impede the adhesion of the labels.

B. Labeling Requirements

1. Labels are to be installed on or for:
 - a. All firestopping systems. For wall and floor penetrations, label on both sides. See Firestopping later in this section.
 - b. All pathways (e.g., conduit etc.) installed under this work.

- 1) Label all conduit with "SECURITY". Conduit labels shall utilize text readable from a standing position on the finished floor. Conduit sleeves which pass through a single wall or floor need not be labeled.
 - a) For wall stub-up locations, label overhead only.
 - b) For conduits greater than 10', label both ends of conduit with far end location and Room/Number.
 - i) Example – "Security to Panel 1 in Equipment Room 127".
 - c) For conduits that stub directly up or into an Equipment Room, label both ends of conduit.
 - i) Example: under slab/ground conduit from Equipment Room 127 to Camera #13 attached to an exterior light pole shall be labeled as follows:
 - (1) Conduit stub-up location in Equipment Room 127 – "Security to Camera #13".
 - (2) In the light pole/junction box, immediately adjacent to serving conduit – "Security to Equipment Room 127".
- 2) All pullboxes and junction boxes for Security shall be labeled "SECURITY PULLBOX" on the cover, such that the text is of sufficient size to be readable from a standing position on the finished floor.
 - a) Conduits entering and exiting all pullboxes and junction boxes shall be labeled with their destination/room number – i.e. "To Security Camera #17 in Room 114".
- c. In general, the label is to be provided and installed by whomever installed the item that is being labeled.
- d. Refer to individual Division 28 sections and to the drawings for additional information on labeling requirements.

3.3 FIRESTOPPING

A. General

1. Provide fire resistant materials of a type and composition necessary to restore fire ratings to all wall, floor, or ceiling penetrations, including membrane penetrations. All materials shall be classified or listed as a complete system by UL (or an approved NRTL by the

Design Consultant and AHJ) and meet NEC and local codes. The use of partial systems or components of systems is not allowed unless specifically identified in the documents.

2. All penetrations through fire rated floors and walls shall be sealed to prevent the passage of smoke, flame, toxic gas, or water through the penetration before, during or after a fire. The fire rating (F and T) of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by referenced building codes.
 - a. Assume all floors are fire-rated, unless otherwise noted.
 - b. Also install fire stops at any other locations indicated in the Specifications or Drawings.
3. Provide a label on both sides of fire rated assembly at all fire stop locations indicating:
 - a. Fire stop Manufacturer
 - b. Installer and company
 - c. Date installed
 - d. UL system number with all relevant ratings indicated
4. Include labels in each Equipment Room in which one or more fire-rated walls is installed. Provide a 2" block letter stencil label on the inside of the room to indicate rating for each barrier.
5. Provide systems as identified on the drawings and specified herein. At locations where the cabling routing encounters a fire-rated barrier provide an adequately sized fire stop device for the quantities and types for all cables to be installed plus 25% growth.

B. Penetration Sealant – Conduits

1. Provide listed system to seal around openings between wall, floor, or partition around conduits in accordance with system listing and manufacturer's instructions.

C. Penetration Sealant – Voids, Cavities, and Openings

1. Install fire stop materials in the framed openings through fire rated partitions per the Architect's drawings and in accordance with the NRTL listed system instructions.
2. Fire stop all voids, cavities, and openings left by the removal of cabling, conduits, conduit sleeves, cable trays or other equipment related to the communications systems not to be reused.

3. Install the fire stop system in accordance with the manufacturer's instructions and local codes.

D. Fire-Rated Pathway Device

1. Provide fire-rated pathway device anywhere cables are required to pass through fire-rated walls, floors, or partitions.
2. Devices shall be installed in locations where required by the Contract Drawings, arranged individually or appropriately ganged.
3. Install the devices in strict accordance with the approved shop drawings and the equipment manufacturer's recommendations.
4. Apply the factory supplied gasketing material (where required) prior to the installation of the wall plates.
5. Secure wall plates (where required) to devices per the equipment manufacturer's recommendations.

END OF SECTION

SECTION 281010 - CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. As part of a complete and functioning Electronic Security System and associated infrastructure, provide conductors and cables of appropriate type. This section includes:
 - 1. Low-voltage Control and Power Cables
 - 2. Coaxial Cabling
- B. Conductor and cable requirements are unique to each manufacturer equipment / device. Unless otherwise noted, exact conductor and cable types are to be coordinated by the ESC to meet the requirements of the Electronic Security manufacturer

1.2 RELATED SECTIONS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Work under this section shall follow Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems".
- C. Conductors and cables as specified in this section shall be supported and installed into pathways, backboxes, firestopping, and other general/common work per Division 28 Section "Common Work Results for Electronic Security Systems".

1.3 SUBMITTALS

- A. Follow the requirements for submittals in Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems".
- B. The following additional requirements are due at the following submittal phases:
 - 1. Pre-Construction Submittal
 - a. Cut sheets shall contain the following information for each of the cables specified:
 - 1) Manufacturers name and logo
 - 2) Cable outside diameter

- 3) Number of conductors/strands in each cable and binder group
- 4) Gauge or strand thickness
- 5) Cable jacket material and rating (i.e. Plenum, Riser, wet-rated, etc.)
- 6) Maximum pulling tension
- 7) Jacket/Sheath color
- 8) Individual conductor or strand insulation colors (if applicable)
- 9) Minimum bend radius
 - a) During installation and post installation if it differs.

b. Shop Drawings

- 1) Cable types required by this Section are to be identified on Shop Drawings for the following Electronic Security sub-systems: (separate 281010 Shop Drawings for this section are not needed)
 - a) Access Control
 - b) Video Intercom
 - c) Video Surveillance
- 2) On the Shop Drawings for those Electronic Security sub-systems, show the proposed routing of all conductors and cables and the means of support:
 - a) Cable Tray
 - b) Conduit (solid line)
 - c) J-hooks every 48"-60" (dashed line), if allowed by Contract Documents
- 3) On the Shop Drawings for those Electronic Security sub-systems, include details showing the proposed termination and labeling (ID) scheme at each device and panel for each conductor/cable.

2. Preliminary Project Completion Submittal

- a. Follow all requirements as specified in Division 28 Section "Electronic Security Systems".

- b. Update the approved shop drawings with any changes in cable routing and submit as part of Preliminary Record Drawings per Division 28 Section "Electronic Security Systems".
- c. Test Results
 - 1) Include conductor/strand test as part of the Functional Test Reports for each Electronic Security sub-system.
- d. Cable ID spreadsheet, saved in PDF and Microsoft Excel file formats, which shall include the following for each cable installed under this section:
 - 1) Electronic Security Sub-System
 - 2) Device Type
 - 3) Device Identifier
 - 4) Device Room Number (if not part of Device Identifier)
 - 5) Headend Panel Identifier
 - 6) Headend Panel Room Number (if not part of Headend Panel Identifier)
 - 7) Cable Identifier

TABLE 1: CABLE IDENTIFICATION SPREADSHEET

<u>Sub-System</u>	<u>Device Type/ID</u>	<u>Device Rm</u>	<u>Headend ID</u>	<u>Headend Rm</u>	<u>Cable ID</u>
Access Control ACP01	Card Reader 01	Vestibule 101	ACP-01	IDF 114	AC-CR01-

- 3. Final Project Completion Submittal
 - a. Follow all requirements as specified in Division 28 Section "Electronic Security Systems".
 - b. Incorporate any changes from punch list items.
 - c. Include updated Cable ID spreadsheet.

1.4 DEFINITIONS

- A. Damp Location – as defined by the NEC, locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. For the purposes of Work under this division, assume all Damp Locations require wet-rated cabling.
- B. Point of Entrance (Building Entrance) – as defined by the NEC, the point within a building where the security cabling routed through a Wet Location emerges from an external wall, a concrete floor slab, or IMC/RMC.
- C. Qualified Electrician – one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved; regarding this project, a Qualified Electrician is also licensed in the jurisdiction of the project to install electrical equipment (i.e. Journeyman or Master Electrician License).
- D. Wet Location - as defined in the NEC, installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL REQUIREMENTS

- A. Conductors and cables shall meet the following the requirements:
 - 1. UL Listed and Approved for the intended application
 - a. Where areas above accessible ceilings are serving as plenum (air) return, and conductors/cabling is not installed in conduit from device to serving panel or Equipment Room, the conductors/cabling shall be Plenum (CMP) rated.
 - b. Where conductors/cabling are installed in conduit from device to serving panel or Equipment Room, the conductors/cabling shall be Riser (CMR) or Plenum rated.
 - c. Where conductors are/cabling are routed through a Wet Location,
 - 2. Cable type and conductor size/quantity shall be as recommended or required by the device/equipment manufacturer. Where the Contract Documents differ from manufacturer recommendations or requirements, notify the Architect requesting clarification.
 - 3. Conductor sizes, if shown, are minimum. Where approved by the Design Consultant and at no extra cost to the Owner, larger conductor sizes may be installed at Contractor's option to utilize stock sizes, provided raceway sizes are increased to correspond with fill ratio requirements defined the NEC.
 - 4. Conductors and cables shall be shielded.

- a. Submit RFI for any manufacturer equipment that recommends non-shielded cable.
- B. The following Manufacturers are conditionally approved:
 1. Belden
 2. Draka
 3. General Cable
 4. Tappan
 5. West Penn Wire

2.2 LOW-VOLTAGE CONTROL AND POWER CABLES

- A. For 10 AWG through 24 AWG, and single conductors through 24-pair applications, as needed per project.
- B. General requirements:
 1. Shielded (overall shield)
 2. Stranded and insulated conductors
 3. PVC jacket
 4. Size conductors per manufacturer recommendations and power/voltage drop based on installed cable length.
- C. Manufacturer shall be:
 1. Submit product cutsheets concurrently with Shop Drawings, identifying cable type, manufacturer, and part number on the Riser Diagram.
 - a. Call out non-plenum (Riser-rated and Wet-rated) cables (where specifically allowed)

2.3 COXIAL CABLING

- A. For distances up to 1000':
 1. RG-59
 - a. General requirements:

- 1) 75-ohm Impedance
 - 2) 20 AWG solid copper conductor
 - b. Plenum-rated cable shall be by:
 - 1) Belden 1506A; or
 - 2) West Penn 25819.
 - c. Wet Locations shall utilize:
 - 1) Belden 5439X5
 - 2) Equal from West Penn
- B. For distances over 1000' and up to 1600':
 - 1. RG-11
 - a. General requirements:
 - 1) 75-ohm Impedance
 - 2) 14 AWG solid copper conductor
 - b. Plenum-rated cable shall be by:
 - 1) Belden 6139B8
 - 2) Equal from West Penn
 - c. Wet Locations shall utilize:
 - 1) Belden 1525A
 - 2) Equal from West Penn

PART 3 - EXECUTION

3.1 CABLE INSTALLATION

A. Pre-Installation

- 1. Following the Notice to Proceed, the ESC's Quality Control Specialist or Project Manager (as defined in Division 28 section "Electronic Security Systems") shall coordinate with the Contractor or Sub-Contractor responsible for Division 28 "Common Work Results for

Electronic Security Systems" (i.e. the conduits, backboxes, etc), if Contractors are different. Items of coordination shall include, but are not limited to:

- a. Conduit routing
 - b. Conduit type for Building Entrance(s) – (see requirements below)
2. Conduit routing and type shall be indicated on at least one of the following Pre-Construction Shop Drawings:
 - a. Division 28 "Common Work Results for Electronic Security"
 - b. Division 28 "Electronic Security Systems"
 3. After conduits/pathways are installed, but prior to cable installation, ESC's Quality Control Specialist and Project Manager shall inspect the Common Work (pathways and backboxes), paying special attention to:
 - a. Conduit sizes and quantities matches Construction Documents and Project requirements
 - b. Minimum bend radius
 - c. Quantity of bends in conduit between pullboxes (180 degree change in direction, maximum)
 - d. Building Entrance conduits are of appropriate type
 - e. Any visible indication of improper or incomplete installation that may damage cable as it is installed.

B. General Requirements

1. Unless otherwise noted, all cables shall be routed through concealed conduit raceway.
 - a. Conduits are not required above accessible (drop) ceilings; when not installed in conduit, cables shall be supported via j-hooks every 48 to 60 inches or less and at every change in direction. For areas where accessible ceiling is not available for pathway back to the Equipment Room, cables may be consolidated and routed in overhead conduit and conduit sleeves.
 - b. Contractor is responsible for determining final cable and conduit routing; conduits may be consolidated in overhead pullboxes in accordance with Division 28 Section "Common Work Results for Electronic Security"; proposed (cable and) conduit routing and sizing shall be indicated on pre-construction shop drawings.

2. Install continuous conductors between outlets, devices and boxes without splices or taps. Do not pull connections into raceways. Leave at least 12 inches of conductor in backbox at each device location.
3. A Qualified Electrician shall install all control wire operating at 120V nominal and above. Control wiring operating at less than 120V (e.g., 12V and 24V) may be installed under the Division furnishing it.
4. All cables shall be plenum-rated unless noted otherwise.
5. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or any other method shall not be used to attach cables to cable supports or to create cable bundles.
 - a. Except when supported by ladder racking within each Telecommunications room, UON.
6. At the same time horizontal cables are pulled into a conduit also install a pull cord to facilitate future cable pulls along those. Use polypropylene or monofilament plastic line with not less than 200 lb. tensile strength. Leave at least 12 inches of slack at each end of pull cord.
7. Do not install kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable
8. Comply with all referenced standards and guidelines.
9. Cables shall be masked, covered, or otherwise protected from being painted or meeting any other substance that may degrade the performance or physical characteristics of the cable jacket or insulation over time.
10. Where space allows, all cables shall be provided with slack/service loops near each end of the cable, one in the accessible ceiling space or overhead J-box at the device and one at the Equipment Room. Each slack/service loop shall be:
 - a. A minimum of 3 feet (1 meter) in length, unless noted otherwise.
12. Prior to using any cable pulling lubricants provide the Design Consultant with written documentation from the cable manufacturer supporting the cable manufacturers' acceptance of its use in compliance with all required warranties as part of these contract documents. The use of non-water based lubricants shall be provided when pulling PVC jacketed and all cables not suitable for contact with water.
13. Install all cables and conductors in compliance with the requirements of Article 725 of the NEC, paying special attention to the following:
 - a. Cables shall be installed in a neat and workmanlike manner.

- b. Separation requirements dependent upon installation location and proximity to other circuits.
- C. Outside plant (OSP)/wet-rated cable installation: for cables placed in Wet Locations or as required by these construction documents. (I.e. all cables which extend beyond the footprint/envelope of the building or pathways leading to floor-boxes embedded in a ground floor slab)
 - 1. No portion of outdoor only (unlisted) cables may be installed with the cable jacket exposed in any plenum or other air handling space nor shall they be allowed to transition between different levels of the building.
 - 2. Rigid or intermediate metallic conduit shall be used to route outdoor (unlisted) cabling to the serving Equipment Room in accordance with the NEC; or a suitably-sized junction box shall be provided in an accessible location within 50' of where the outdoor cabling/conduit enters the building to allow the cable to transition from wet-rated to plenum-rated.
 - a. Indicate this location on pre-construction shop drawings and final Record Drawings.
 - 3. All cables which extend beyond the envelope/footprint of the building shall be installed with entrance protectors in accordance with Division 28 Section "Equipment Room Fittings for Electronic Security".

3.2 CABLE IDENTIFICATION

- A. Label all cabling with machine-printed labels according to the labeling scheme identified on the drawings or as described in Division 28 Section "Electronic Security Systems". Where the drawings and specifications are silent, submit RFI through appropriate channels requesting labeling scheme.
 - 1. Shop drawings shall include floor plan and/or riser diagram that indicates proposed cable/device identification for each device.
- B. Cables shall be labeled within 6" at each end.
- C. All cable labels shall be thermal-transfer type and utilize self-adhesive labels. The following are approved manufacturers:
 - 1. Brady, IDXPert
 - 2. Hellermann Tyton, Spirit 2100
 - 3. Panduit LS9
 - 4. Or equivalent

3.3 GENERAL CABLE TESTING

A. Pre-installation testing:

1. Visually inspect all cables, cable reels/boxes, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
2. Do not install any cable with less than the manufacturer's guaranteed number of serviceable conductors.

B. Post-installation testing (but prior to termination to devices/panels):

1. Conduct cable continuity testing upon completion of installation on each conductor.
2. Remove all defective cables from pathway systems. Do not abandon cables in place.

3.4 CABLE TERMINATIONS

- #### A.
- Cable connections to device and security panel shall be soldered and heat-shrunk from jacket to jacket. Exposed conductors, even within an enclosure or backbox, are not allowed.

3.5 ACCEPTANCE

- #### A.
- The ESC's Quality Control Specialist shall conduct an inspection after conductors and cabling have been installed to ensure compliance with the Construction Documents and project requirements.
- #### B.
- Functional tests of the conductors and cables connected to equipment will be conducted by the ESC as part of Test Reports as specified in Division 28 "Electronic Security Systems" and individual Electronic Security sub-system Sections.

END OF SECTION

SECTION 284600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.
- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
 - 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
 - 12. Certification by Contractor that the system design complies with Contract Documents.
- D. Evidence of installer qualifications.
- E. Inspection and Test Reports:
 - 1. Submit inspection and test plan prior to closeout demonstration.

2. Submit documentation of satisfactory inspections and tests.
 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- F. Operating and Maintenance Data: See Section 017800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 4. List of recommended spare parts, tools, and instruments for testing.
 5. Replacement parts list with current prices, and source of supply.
 6. Detailed troubleshooting guide and large scale input/output matrix.
 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- G. Project Record Documents: See Section 017800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- H. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.04 WARRANTY

- A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm Control Units and Accessories:
1. Honeywell Security & Fire Solutions/Notifier; [____]: www.notifier.com/#sle.
 2. Honeywell Security & Fire Solutions/Silent Knight; [____]: www.silentknight.com/#sle.
 3. Siemens Building Technologies, Inc; [____]: www.usa.siemens.com/#sle.
 4. Simplex, a brand of Johnson Controls; [____]: www.simplex-fire.com/#sle.
 5. Provide control units made by the same manufacturer.
- B. Initiating Devices and Notification Appliances:
1. Same manufacturer as control units.

2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
 2. Protected Premises: Entire building shown on drawings.
 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
 - a. ADA Standards.
 - b. The requirements of the State Fire Marshal.
 - c. The requirements of the local authority having jurisdiction .
 - d. Applicable local codes.
 - e. Contract Documents (drawings and specifications).
 - f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
 7. Program notification zones and voice messages as directed by Owner.
 8. Fire Command Center: Location indicated on drawings.
 9. Fire Alarm Control Unit: New, located at supervising station.
- B. Supervising Stations and Fire Department Connections:
 1. Public Fire Department Notification: By on-premises supervising station.
 2. On-Premises Supervising Station: New proprietary station operated by Owner, located at [_____].
 3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
- C. Circuits:
 1. Initiating Device Circuits (IDC): Class B, Style A.
 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Power Sources:
 1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
 1. Sprinkler water control valves.
 2. Dry-pipe sprinkler system pressure.
 3. Dry-pipe sprinkler valve room low temperature.

- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
 - 1. Sprinkler water flow.
 - 2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
 - 3. Generator room heat detector.
 - 4. Duct smoke detectors.
- C. HVAC:
 - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.04 COMPONENTS

- A. General:
 - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: [_____].
- D. Initiating Devices:
 - 1. Addressable Systems:
 - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
 - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
 - 2. Manual Pull Stations: [_____].
 - 3. Smoke Detectors: [_____].
 - 4. Duct Smoke Detectors: [_____].
 - 5. Heat Detectors: [_____].
- E. Notification Appliances:
 - 1. Strobes: [_____].
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 - 2. Provide one for each control unit where operations are to be performed.
 - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 - 4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.

- D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.03 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of the required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.

3.04 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
 - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
 - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
 - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
 - 1. Provide on-site response within 2 hours of notification.
 - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
 - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION 284600

SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subsoil materials.
2. Topsoil materials.

B. Related Requirements:

1. Section 003132 "Geotechnical Data."
2. Section 310516 "Aggregates for Earthwork."
3. Section 312213 "Rough Grading."
4. Section 312316 "Excavation."
5. Section 312323 "Fill."
6. Section 329300 "Plants."

1.2 REFERENCE STANDARDS

- A. ASTM International: ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.3 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.
- B. Product Data: Submit name of imported materials source.
- C. Samples: Submit, in airtight containers, 10-pound sample of each type of fill to testing laboratory.
- D. Supplier's Certificate: Certify that products meet or exceed specified requirements.
- E. Source Quality-Control Submittals: Indicate results of tests and inspections.

1.4 QUALITY ASSURANCE

- A. Furnish each subsoil and topsoil material from single source throughout Work.
- B. Perform Work in accordance with Section 003132 "Geotechnical Data," the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan

Chapter of the American Public Works Association Construction and Materials Specification
Section 2100. The most stringent requirements shall apply herein.

- C. Maintain 1 copy of each standard affecting Work of this Section on site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Subsoil:

- 1. Type S1: Structural.
 - a. As defined in Section 003132 "Geotechnical Data."
- 2. Type S2: Low-Volume Change Material.
 - a. As defined in Section 003132 "Geotechnical Data."

B. Topsoil:

- 1. Type S3: Topsoil
 - a. Excavated and reused material.
 - b. Graded and double screened.
 - c. Free of roots, rocks larger than 1/2-inch, subsoil, debris, large weeds, and foreign matter.
 - d. Comply with ASTM D2487 Group Symbol OH or PT.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 "Quality Requirements" for requirements for testing, inspection, and analysis.
- B. Testing and Analysis: Comply with Section 003132 "Geotechnical Report." Use the following schedule if unspecified in Section 003132:
 - 1. Subsoil Material: Comply with ASTM D2487.
 - 2. Topsoil Material: Comply with ASTM D2487.
 - 3. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Owner Inspection:
 - 1. Make subsoil and topsoil available for inspection at source prior to packaging for shipment.
 - 2. Notify Owner at least 7 days before inspection is allowed.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

D. Owner Witnessing:

1. Allow witnessing of source testing at supplier's test facility.
2. Notify Owner at least 7 days before tests are scheduled.

E. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 310513

SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Coarse-aggregate materials.
2. Fine-aggregate materials.

B. Related Requirements:

1. Section 003132 "Geotechnical Data."
2. Section 310513 "Soils for Earthwork."
3. Section 312213 "Rough Grading."
4. Section 312316 "Excavation."
5. Section 312323 "Fill."
6. Section 331416 "Site Water Utility Distribution Piping."
7. Section 333100 "Sanitary Sewerage Piping."
8. Section 334200 "Stormwater Conveyance."

1.2 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.
- B. Product Data: Submit name of imported materials source.
- C. Samples: Submit, in airtight containers, 10-lb. sample of each type of fill to testing laboratory.
- D. Supplier's Certificate: Certify that products meet or exceed specified requirements.
- E. Source Quality-Control Submittals: Indicate results of tests and inspections.

1.3 QUALITY ASSURANCE

- A. Furnish each coarse- and fine-aggregate material from single source throughout Work.
- B. Perform Work in accordance with Section 003132, the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent requirements shall apply herein.
- C. Maintain 1 copy of each standard affecting Work of this Section on site.

1.4 MATERIALS

A. Aggregate:

1. Type A1: ASTM C33. Gradation requirements for bedding materials per the City of Lee's Summit, Missouri Standard Specifications Section 2100 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100.
2. Type A2: KDOT AB-3.
3. Type A3: ASTM D448 No. 467, No. 57, or No. 67.

1.5 SOURCE QUALITY CONTROL

A. Section 014000 "Quality Requirements" for requirements for testing, inspection, and analysis.

B. Testing and Analysis:

1. Comply with Section 003132, the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent testing and analysis requirements shall apply when conflicting information is presented.
2. If tests indicate materials do not meet specified requirements, change material and retest.

C. Owner Inspection:

1. Make subsoil and topsoil available for inspection at source prior to packaging for shipment.
2. Notify Owner at least 7 days before inspection is allowed.

D. Owner Witnessing:

1. Allow witnessing of source testing at supplier's test facility.
2. Notify Owner at least 7 days before tests are scheduled.

E. Certificate of Compliance:

1. If supplier is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at source conforms to Contract Documents.
2. Specified source tests are not required for Work performed by approved supplier.

END OF SECTION 310516

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing surface debris.
2. Removing designated paving, curb and gutter, etc.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.

B. Related Sections: Section 312213 "Rough Grading."

1.2 QUALITY ASSURANCE

- A. Conform to applicable code for environmental requirements, disposal of debris, burning debris on site, use of herbicides, etc.
- B. Perform Work in accordance with City of Lee's Summit Standard Specifications Section 2100 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Material Specifications Section 2100.
- C. Maintain 1 copy of each document on site.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXECUTION, GENERAL

- A. Perform Work in accordance with City of Lee's Summit Standard Specifications Section 2100 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Material Specifications Section 2100.

END OF SECTION 311000

SECTION 312213 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, grading, filling, rough contouring, and compacting site.

B. Related Sections:

1. Section 003132 "Geotechnical Data."
2. Section 310513 "Soils for Earthwork."
Section 310516 "Aggregates for Earthwork."
3. Section 311000 "Site Clearing."
4. Section 312316 "Excavation."
5. Section 312323 "Fill."

1.2 REFERENCES

A. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
3. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
4. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. Section 013300 "Submittal Procedures" for requirements for submittals.

B. Samples: Submit, in air-tight containers, 10-pound sample of each type of fill to testing laboratory.

C. Materials Source: Submit name of imported materials suppliers.

- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 "Execution and Closeout Requirements" for requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.
- B. Perform Work in accordance with Section 003132 - Geotechnical Data, the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent requirements shall apply herein.
- C. Maintain 1 copy of each document on site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Type S3 as specified in Section 310513 "Soils for Earthwork."
- B. Structural Fill: Type S1 as specified in Section 310513 "Soils for Earthwork."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 013000 "Administrative Requirements" for verification of existing conditions before starting work.
- B. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

- A. Call Local Utility Line Information service at 811 not less than 3 working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility company to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- F. Protect benchmarks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, relandscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site and protect from erosion. Stockpile material on impervious material and cover over with same material until disposal.
- D. Remove excess topsoil not intended for reuse from site.

3.4 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated, relandscaped, or regraded.
- B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.
- C. When excavating through roots, perform Work by hand and cut roots with sharp axe.
- D. Remove excess subsoil not intended for reuse, from site.
- E. Benching Slopes: Horizontally bench existing slopes greater than 5:1 (H:V) to key placed fill material to slope to provide firm bearing.
- F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

- A. Fill areas to contours and elevations with unfrozen materials.

- B. Place fill material in continuous layers and compact in accordance with Section 003132 - Geotechnical Data, the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent compaction requirements shall apply if conflicting information is presented.
- C. Maintain optimum moisture content of fill materials to attain required compaction density.
- D. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise.
- E. Make grade changes gradual. Blend slope into level areas.
- F. Repair or replace items indicated to remain damaged by excavation or filling.

3.6 TOLERANCES

- A. Section 014000 "Quality Requirements" for tolerances.
- B. Top Surface of Subgrade: Plus or minus 1/10-foot from required elevation.

3.7 FIELD QUALITY CONTROL

- A. Section 017000 "Execution and Closeout Requirements" for field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests and in-place compaction tests in accordance with Section 003132 - Geotechnical Data, the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent laboratory material tests and in-place compaction tests shall apply if conflicting information is presented.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 312213

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating for building foundations.
2. Excavating for paving, roads, and parking areas.
3. Excavating for slabs-on-grade.
4. Excavating for Site structures.
5. Excavating for landscaping.

B. Related Requirements:

1. Section 003132 "Geotechnical Data."
2. Section 310513 "Soils for Earthwork."
3. Section 310516 "Aggregates for Earthwork."
4. Section 312213 "Rough Grading."
5. Section 312323 "Fill."

1.2 REFERENCE STANDARDS

- A. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.

B. Shop Drawings:

1. Excavation Protection Plan:

- a. Describe sheeting, shoring, and bracing materials and installation, as required, to protect excavations and adjacent structures and property.
- b. Submit signed and sealed Shop Drawings with design calculations and assumptions to support plan.

- C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

- D. Qualifications Statement: Submit qualifications for licensed professional.

1.4 QUALITY ASSURANCE

- A. Perform Work according to authority having jurisdiction.
- B. Maintain 1 copy of each standard affecting Work of this Section on site.

1.5 QUALIFICATIONS

- A. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Missouri.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation preparation.
- B. Utility Service Locator:
 - 1. Call local utility service-line information at 811 not less than 3 working days before performing Work.
 - 2. Request that underground utilities be located and marked within and immediately surrounding construction areas.
 - 3. Identify required lines, levels, contours, and data.
- C. Existing Utilities:
 - 1. Notify utility company to remove and relocate utilities.
 - 2. Protect from damage utilities indicated to remain.
- D. Protect plant life, lawns, and other features designated to remain as portion of final landscaping.
- E. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- F. Do not close or obstruct roadways, sidewalks, or hydrants without permits.
- G. Erect and maintain temporary barriers and security devices, including warning signs, warning lights, and similar measures, for protection of public, Owner, and existing improvements indicated to remain.

3.2 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation Work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, site structures, and construction operations.
- C. Excavate to working elevation for piling Work.
- D. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity, as specified in Section 312323 "Fill."
- E. Slope banks with machine to angle of repose or less until shored.
- F. Do not interfere with 45-degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Trim excavation and remove loose matter.
- I. Removal of Deleterious Materials:
 - 1. Remove lumped subsoil, boulders, and rock up to 1/3 cu. yd., measured by volume.
 - 2. Remove larger material as specified in Section 312323 "Fill."
 - 3. Remove excess and unsuitable material from site.
- J. Notify Architect/Engineer of unexpected subsurface conditions.
- K. Correct over-excavated areas with CLSM or with structural fill Type S1 as specified in Section 312323 - Fill.
- L. Remove excavated material from site.
- M. Repair or replace items indicated to remain that have been damaged by excavation.

3.3 FIELD QUALITY CONTROL

- A. Section 017000 "Execution and Closeout Requirements" for requirements for testing, adjusting, and balancing.
- B. Inspecting: Request visual inspection of bearing surfaces by inspection agency before installing subsequent Work.

3.4 PROTECTION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for protecting finished Work.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Prevent displacement or loose soil from falling into excavation and maintain soil stability.
- C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- D. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that may be created by earth operations.

END OF SECTION 312316

SECTION 312323 - FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backfilling building perimeter to subgrade elevations.
2. Fill under paving.
3. Fill for over-excavation.

B. Related Requirements:

1. Section 003132 "Geotechnical Data."
2. Section 310513 "Soils for Earthwork."
3. Section 310516 "Aggregates for Earthwork."
4. Section 312213 "Rough Grading."
5. Section 312316 "Excavation."

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
2. ASTM D6031/D6031M - Standard Test Method for Logging In-Situ Moisture Content and Density of Soil and Rock by the Nuclear Method in Horizontal, Slanted, and Vertical Access Tubes.
3. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.
- B. Product Data: Submit manufacturer information for geotextile fabric, indicating fabric and construction.
- C. Samples: Submit, in airtight containers, one 10-pound sample of each type of fill to testing laboratory.
- D. Materials Source: Submit name of imported materials suppliers.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 QUALITY ASSURANCE

- A. Perform Work according to Section 003132 "Geotechnical Data," the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent requirements shall apply herein.
- B. Maintain 1 copy of each standard affecting Work of this Section on site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Fill: Type S1, as specified in Section 310513 "Soils for Earthwork."
- B. Low-Volume Change Material: Type S2, as specified in Section 310513 "Soils for Earthwork."
- C. Granular Fill: Type A2 and Type A3, as specified in Section 310516 "Aggregates for Earthwork."
- D. Flowable Backfill/Controlled Low-Strength Material (CLSM): As specified in the City of Lee's Summit, Missouri Standard Specifications Section 2100 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100.

2.2 ACCESSORIES

- A. Geotextile Fabric: As specified in the City of Lee's Summit, Missouri Standard Specifications Section 2100 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation examination.
- B. Verify that subdrainage, dampproofing, and waterproofing installations have been inspected.
- C. Verify that underground tanks are anchored to their own foundations to avoid flotation after backfilling.

- D. Verify structural integrity of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation preparation.
- B. Compact subgrade to specified density requirements for subsequent backfill materials.
- C. Soft Subgrade:
 - 1. Cut out soft areas of subgrade not capable of compaction in place.
 - 2. Backfill with structural fill and compact to density equal to or greater than specified requirements for subsequent fill material.
- D. Scarify subgrade surface.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations.
- B. Systematically backfill to allow maximum time for natural settlement.
- C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces, and do not backfill with frozen materials.
- D. Geotextile: Place geotextile fabric as indicated on Drawings.
- E. Place fill material in continuous layers and compact according to Section 003132 "Geotechnical Data," the City of Lee's Summit, Missouri Standard Specifications Section 2100, and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2100. The most stringent compaction requirements shall apply when conflicting information is presented.
- F. Use placement method that does not disturb or damage foundation perimeter drainage, utilities in trench, etc.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Structures:
 - 1. Backfill against supported foundation walls.
 - 2. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
 - 3. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet.
- I. Make gradual grade changes and blend slope into level areas.

- J. Remove surplus backfill materials from site.
- K. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

- A. Section 014000 "Quality Requirements" for requirements for tolerances.
- B. Top Surface of Backfilling within Building Areas: Plus or minus 1 inch from required elevations.
- C. Top Surface of Backfilling under Paved Areas: Plus or minus 1 inch from required elevations.
- D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

- A. Section 017000 "Execution and Closeout Requirements" for requirements for testing, adjusting, and balancing.
- B. Inspecting: Request visual inspection of bearing surfaces by inspection agency before installing subsequent Work.
- C. Testing:
 - 1. Laboratory Material Testing: Comply with ASTM D698.
 - 2. In-Place Compaction Testing:
 - a. Density Tests: Comply with ASTM D6938.
 - b. Moisture Tests: Comply with ASTM D6031/D6031M.
 - 3. If tests indicate that Work does not meet specified requirements, remove Work, replace, compact, and retest.
 - 4. Proof-roll compacted fill surfaces under slabs-on-grade, pavers, and paving in accordance with Section 003132 "Geotechnical Data."

3.6 PROTECTION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for protecting finished Work.
- B. Reshape and recompact fills subjected to vehicular traffic during construction.

3.7 ATTACHMENTS

- A. Interior Slab-on-Grade: In accordance with Section 003132 "Geotechnical Data."
- B. Exterior Side of Foundation Walls and over Granular Filter Material and Foundation Perimeter Drainage:
 - 1. Fill Type S1; 6 inches thick; compacted to 95 percent of maximum density.
 - 2. Frequency of Tests: 1 test per lift.
 - 3. Required Field Water Content: Minus 3 percent to plus 3 percent of optimum moisture content.
- C. Fill to Correct Over-Excavation:
 - 1. Fill Type S1; flush to specified elevation; compacted uniformly to 95 percent of maximum density.
 - 2. Frequency of Tests: 1 test per 6-inch lift.
 - 3. Required Field Water Content: Minus 3 percent to plus 3 percent of optimum moisture content.

END OF SECTION 312323

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

SECTION 321213 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Refer to the City of Lee's Summit, Missouri Standard Specification "LS Section 2200 – Paving" for concrete paving requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 321213

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Refer to the City of Lee's Summit, Missouri Standard Specification "LS Section 2200 – Paving" for asphalt paving requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 321216

SECTION 329000 - PLANTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Plants, soils, edging, and landscape materials.

1.2 DEFINITIONS

- A. Pesticide: Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and is specifically labeled for use by U.S. Environmental Protection Agency (EPA). Also, any substance used as plant regulator, defoliant, disinfectant, or biocide.
- B. Planter Bed: An area containing 1 or combination of following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, and mulch topdressing, excluding turf. Trees may also be found in planter beds.

1.3 APPLICABLE PUBLICATIONS

- A. Comply with references to extent specified in this Section.
- B. American National Standards Institute (ANSI): Z60.1-2014 - Nursery Stock.
- C. American Society for Testing and Materials (ASTM):
 - 1. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. C33/C33M-16 - Concrete Aggregates.
 - 4. C136/C136M-14 - Sieve Analysis of Fine and Coarse Aggregates.
 - 5. C602-13a - Agricultural Liming Materials.
 - 6. D977-13e1 - Emulsified Asphalt.
 - 7. D5268-13 - Topsoil Used for Landscaping Purposes.
- D. Hortus Third: Concise Dictionary of Plants Cultivated in United States and Canada.
- E. Tree Care Industry Association (TCIA):
 - 1. A300P1-2008 - Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance Standard Practices (Pruning).
 - 2. Z133.1-2012 - Arboricultural Operations - Safety Requirements.

F. United States Department of Agriculture (USDA):

1. DOA SSIR 42-2014 - Soil Survey Laboratory Methods Manual.
2. Handbook No. 60 - Diagnosis and Improvement of Saline and Alkali Soils.

1.4 SUBMITTALS

A. Submittal Procedures: Section 013323, Shop Drawings, Product Data, and Samples.

B. Manufacturer's Literature and Data:

1. Photographs: Color photographs of each plant species showing actual size and condition of plants to be provided with measuring device included for scale. Where more than 20 plants are required of any species, submit minimum 3 photographs of average, best, and worst quality plant to be provided. Include on each photograph plant full scientific name, common name, size, method of harvest (hand dug, mechanical spade dug, container grown, bare root, etc.), and source nursery name, address, contact name, phone and e-mail.
2. Certification Tags: For turfgrass sod and seed, provide USDA certification tags from seed supplier.
3. Installation instructions.
4. Warranty.

C. Samples:

1. Organic and Compost Mulch: 1 quart sealed plastic bag of each required mulch, including label with percentage weight of each material and source representing material to be provided. Samples to match color, texture, and composition of installed material.
2. Mineral Mulch: 2 lb. sealed plastic bag of mulch, including label with source. Samples to match color, texture, and composition of installed material.
3. Filter Fabric: 12 by 12 inches.
4. Edging Materials and Accessories: Manufacturer's standard sizes.
5. Tree Wrap: Width of panel by 12 inches.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
2. Bio-based Content: Show type and quantity for each product.

E. Test reports: Certify products comply with Specifications.

F. Certificates: Certify products comply with Specifications.

1. Plant Materials: Department of Agriculture nursery certification by State Nursery Inspector declaring material to be free from insects and disease.
2. Seed and Turf Materials: Notarized certificate of product analysis.

- G. Qualifications: Substantiate qualifications comply with Specifications.
 - 1. Installer, including supervisor with project experience list.
- H. Operation and Maintenance Data: Care instructions for each plant material.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Regularly installs specified products.
 - 2. Installed specified products with satisfactory service on 5 similar installations for minimum 5 years.
 - a. Project Experience List: Provide contact names and addresses for completed projects.
 - 3. Member in good standing of either Professional Landcare Network, International Society of Arboriculture, State Arborist Association or American Nursery and Landscape Association.
 - 4. Field supervisor certified in 1 or more of the following categories from Professional Landcare Network or International Society of Arboriculture.
 - a. Certified Landscape Technician (CLT) - Exterior, with installation and maintenance specialty areas, designated CLT-Exterior.
 - b. Certified Ornamental Landscape Professional, designated COLP.
- B. Certified Arborist (ISA). Licensed Arborist required to submit 1 copy of license.
- C. Independent or university laboratory, recognized by State Department of Agriculture, with experience and capability to conduct testing indicated and that specializes in types of tests to be performed.
- D. Measure plants according to ANSI Z60.1. Pruning to obtain required sizes will not be permitted. Plants not pruned during production to obtain required sizes will not be permitted.
- E. Inspect and photo document roots of container grown trees/plants prior to planting. Root bound stock will not be permitted.
- F. Balled and burlap trees shall be inspected for location of root flare and any excess soil shall be removed to expose root flare prior to planting. Trees with this condition will be rejected if secondary root flare growth above the primary root flare is found and damage to the tree's root system will result from removing the excess over-plow soil.
- G. Preinstallation Conference: Conduct conference at Project site.

- H. Material Test Reports: For standardized ASTM D5268 topsoil, existing native surface topsoil, existing in-place surface soil and imported or manufactured topsoil.
1. For each unamended soil type, provide soil analysis and written report by qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of soil.
 2. Comply with USDA's Handbook No. 60 testing methods and written recommendations.
 3. Soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken. Take minimum 3 representative samples from varied locations for each soil to be used or amended for planting purposes.
 4. Report suitability of tested soil for plant growth.
 5. Based on test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1,000 sq. ft. or volume per 1 cu. yd. for nitrogen, phosphorus, potassium and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 6. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.6 DELIVERY

- A. Deliver packaged products in manufacturer's original sealed packaging.
- B. Bulk Products:
1. Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.
 2. Install erosion control materials to prevent erosion or displacement of bulk products.
- C. Apply antidesiccant to trees and shrubs according to manufacturer's instructions to protect during digging, handling, and transportation.
1. For deciduous trees or shrubs in full leaf, spray with antidesiccant at nursery before transporting and again 2 weeks after planting.
- D. Wrap trees and shrubs with tree wrap according to manufacturer's instructions to protect from wind and other damage during digging, handling, and transportation.
- E. Deliver branched plants with branches tied and exposed branches covered with material that allows air circulation. Prevent damage to branches, trunks, root systems, and root balls and desiccation of leaves.
- F. Use of equipment such as "tree spades" is permitted provided plant balls are sized according to ANSI Z60.1 and tops are protected from damage.

1.7 STORAGE AND HANDLING

- A. Store bulbs, corms, and tubers in dry location at 60 to 65 degrees F until planting.
- B. Store seeds and other packaged materials in dry locations away from contaminants.
- C. Plant Storage and Protection: Store and protect plants not planted on day of arrival at Project site as follows:
 - 1. Shade and protect plants in outdoor storage areas from wind and direct sunlight until planted.
 - 2. Protect balled and burlapped plants from freezing or drying out by covering balls or roots with moist burlap, sawdust, wood chips, shredded bark, peat moss, or other approved material. Provide covering that allows air circulation.
 - 3. Keep plants in moist condition until planted by watering with fine mist spray.
 - 4. Do not store plant materials directly on concrete or bituminous surfaces.
- D. Topsoil: Before stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation 3 to 4 weeks before stockpiling existing topsoil.
- E. Root Control Barrier and Weed Control Fabric: Store materials on site in enclosures or under protective covering in dry location out of direct sunlight. Do not store materials directly on ground.
- F. Handling: Do not drop or dump plants from vehicles. Avoid damaging plants being moved from nursery or storage area to planting site. Handle balled and burlapped, balled and potted, container plants carefully to avoid damaging or breaking earth ball or root structure. Do not handle plants by trunk or stem. Remove damaged plants from Project site.

1.8 FIELD CONDITIONS

- A. Environment:
 - 1. Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.
 - 2. Planting Dates:
 - a. Deciduous Material: From February 1 to May 15 for spring planting and from September 1 to November 15 for fall.
 - b. Evergreen Material: March 15 to May 15 for spring planting. Evergreen material shall not be planted in the fall or winter.
 - c. Turfgrass Sod: From March 1 to September 15 (not before irrigation system installed, tested and approved).
 - d. Turfgrass Seed: September 1 to October 15 for fall planting and April 15 to July 1 for spring planting (not before irrigation system installed, tested and approved).
 - 3. Restrictions: Do not plant when ground is frozen, snow covered, excessively muddy, or when air temperature exceed 90 degrees F.

- B. Weather Limitations: Install plantings only during current and forecasted weather conditions that comply with plant requirements. Apply associated products in compliance with manufacturers' instructions.

1.9 WARRANTY

- A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
- B. Manufacturer's Warranty: Warrant plantings and against material defects.
 - 1. Warranty Period: 1 year.
 - 2. Plant and turf warranty periods will begin from date of acceptance of Project or phase for beneficial use and occupancy.
 - 3. Remove any dead, missing, or defective plant material immediately and replace at next acceptable planting period. Replace any dead, missing, or defective turf immediately. Warranty Period will end on date of this inspection provided Contractor has complied with warranty work required by this Specification. Comply with following requirements:
 - a. Replace any plants more than 25 percent dead, missing or defective plant material before final inspection.
 - b. Only 1 replacement of each plant will be required except when losses or replacements are due to failure to comply with these requirements.
 - c. Repair damage caused while making plant or turf replacements.
 - 4. Remove stakes, guy wires/straps at end of 1 year warranty.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

- A. Provide each product from 1 source or manufacturer.

2.2 PLANT MATERIALS

- A. Plant Materials: ANSI Z60.1, conforming to varieties specified and be true to scientific name as listed in Hortus Third. Well-branched, well-formed, sound, vigorous, healthy planting stock free from disease, sunscald, windburn, abrasion, and harmful insects or insect eggs and having healthy, normal, and undamaged root system.
 - 1. Trees-Deciduous and Evergreen: Single trunked with single leader, unless otherwise indicated; symmetrically developed deciduous trees and shrubs of uniform habit of growth; straight boles or stems; free from objectionable disfigurements; evergreen trees and shrubs with well-developed symmetrical tops, with typical spread of branches for each particular species or variety. Trees with damaged, crooked, or multiple leaders; tight vertical branches

- where bark is squeezed between 2 branches or between branch and trunk; crossing trunks; cut-off limbs more than 3/4-inch in diameter; or with stem girdling roots will be rejected.
2. Ground Cover and Vine Plants: Provide number and length of runners for size specified on Drawings, together with proper age for grade of plants specified. Provide vines and ground cover plants well established in removable containers, integral containers, or formed homogeneous soil sections. Provide plants grown under climatic conditions similar to those in locality of Project. Spray all plants budding into leaf or having soft growth with an antidesiccant at nursery before digging.
 3. Provide plants of sizes indicated, measured before pruning with branches in normal position. Plants larger in size than specified are acceptable, with no change in Contract price. When larger plants are used, increase ball of earth or spread of roots according to ANSI Z60.1.
 4. Provide nursery-grown plant material conforming to requirements and recommendations of ANSI Z60.1. Dig and prepare plants for shipment in manner that will not cause damage to branches, shape, and future development after planting.
 5. Balled and burlapped (B&B) plant ball sizes and ratios will conform to ANSI Z60.1, consisting of firm, natural balls of soil wrapped firmly with burlap or strong cloth, supported by a wire basket and tied.
 6. Container-grown plants shall have sufficient root growth to hold earth intact when removed from containers, but not be root bound.
 7. Make substitutions only when plant (or alternates as specified) is not obtainable and Landscape Architect authorizes change order providing for use of nearest equivalent obtainable size or variety of plant with same essential characteristics and an equitable adjustment of Contract price.
 8. Existing Plants to be Relocated: Ball sizes to conform to requirements for collected plants in ANSI Z60.1, and plants dug, handled, and replanted according to applicable articles of this Section.
 9. Only plants grown in nursery are permitted.
- B. Label plants with durable, waterproof labels in weather-resistant ink. Provide labels stating correct botanical and common plant name and variety and size as specified in list of required plants. Groups of plants may be labeled by tagging 1 plant. Labels shall be legible for minimum 60 days after delivery to planting site.

2.3 PLANTING SOILS

- A. Planting Soil: Evaluate soil for use as topsoil according to ASTM D5268. From 5 to 10 percent organic matter as determined by topsoil composition tests of Organic Carbon, 6A, Chemical Analysis Method described in USDA DOA SSIR 42. Maximum particle size, 3/4-inch), with maximum 3 percent retained on 1/4-inch screen. Mix topsoil with following soil amendments and fertilizers as recommended by soils analysis.
- B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 1. Supplement with planting soil when quantities are insufficient.

2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by soils analysis.
- C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources are acceptable if sufficient topsoil is not available on site to meet specified depth. At least 10 days before topsoil delivery, notify Landscape Architect of topsoil sources. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil is at least 4 inches deep. Topsoil from bogs, or marshes will be rejected.

2.4 INORGANIC SOIL AMENDMENTS

- A. Lime: Commercial grade limestone containing calcium carbonate equivalent (CCE) specified in ASTM C602 of minimum 80 percent.
- B. Sulfur: 100 percent elemental.
- C. Iron Sulfate: 100 percent elemental.
- D. Aluminum Sulfate: Commercial grade.
- E. Perlite: Horticultural grade.
- F. Agricultural Gypsum: Coarsely ground from recycled scrap gypsum board comprised of calcium sulfate dehydrate 91 percent, calcium 22 percent, sulfur 17 percent, minimum 96 percent passing through 850 micrometers 20 mesh screen, 100 percent passing through 970 micrometers 16 mesh screen.
- G. Coarse Sand: ASTM C33/C33M, clean and free of materials harmful to plants.
- H. Vermiculite: Horticultural grade for planters.
- I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.5 ORGANIC SOIL AMENDMENTS

- A. Organic Matter: Commercially prepared compost. Free of substances toxic to plantings and as follows:
 1. Organic Matter Content: Wood cellulose fiber, wood chips, ground or shredded bark, shredded hardwood, bark peelings, pine straw mulch, or pine needles from Project site when available. Bio-based content 100 percent. Wood cellulose fiber processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to appropriate color to facilitate visual metering of materials application.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Peat: Natural product of sphagnum moss peat derived from fresh-water site, conforming to ASTM D4427 and containing no invasive species, including seeds. Shred and granulate peat to pass 1/2-inch mesh screen and condition in storage pile for minimum 6 months after excavation. Bio-based content minimum 100 percent.
- C. Composted Derivatives: Ground bark, nitolized sawdust, humus, or other green wood waste material free of stones, sticks, invasive species, including seeds, and soil stabilized with nitrogen and having following properties:
 1. Particle Size: Minimum percent by weight passing:
 - a. No. 4 Mesh Screen: 95.
 - b. No. 8 Mesh Screen: 80.
 2. Nitrogen Content: Minimum percent based on dry weight:
 - a. Fir Sawdust: 0.7.
 - b. Fir or Pine Bark: 1.0.
 3. Bio-based Content: 100 percent.
- D. Manure: Well-rotted, horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks, soil, and other invasive species.

2.6 PLANT FERTILIZERS

- A. Soil Test: Evaluate existing soil conditions and requirements before fertilizer selection and application to minimize use of all fertilizers and chemical products. Obtain approval of Landscape Architect for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and warranty requirements. Fertilizers shall be registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer applicable to specific areas as required for Project conditions and application. Provide commercial-grade plant and turf fertilizers, free flowing, uniform in composition and conforming to applicable State and Federal regulations.
- B. Fertilizer for groundcover, wildflowers, and grasses is not acceptable. Provide fertilizer for trees, plants, and shrubs as recommended by plant supplier, except synthetic chemical fertilizers are not acceptable. Fertilizers containing petrochemical additives or that have been treated with pesticides or herbicides are not acceptable.
- C. Granular Fertilizer: Organic, granular controlled-release fertilizer containing minimum percentages, by weight, of plant food nutrients.

1. Composition: Nitrogen, phosphorous, potassium, sulfur, and iron in amounts recommended in soil reports from qualified soil-testing laboratory.

2.7 TURFGRASS FERTILIZER

- A. Provide commercial-grade granular fertilizer, free flowing, uniform in composition, and complying with applicable State and Federal regulations. Submit fertilizer manufacturer's warranted statement of analysis. Fertilizer containing minimum 20 percent nitrogen by weight (50 percent from controlled release source such as sulfur coated urea), 5 percent available phosphoric acid, and 15 percent potash. Liquid starter fertilizer for hydro mulch slurry, commercial type with 50 percent of nitrogen from controlled release source.

2.8 WEED-CONTROL FABRIC

- A. Roll Type Polypropylene or Polyester Mats: Woven, needle punched, or non-woven fabric treated for protection against deterioration due to ultraviolet radiation. Minimum 99 percent opaque to prevent photosynthesis and seed germination, fabric allows air, water, and nutrients to pass through to plant roots.
 1. Minimum weight: 5 ounces per square yard.
 2. Minimum thickness: 20 mils.

2.9 MULCH

- A. Organic Mulch:
 1. Wood cellulose fiber and shredded hardwood for Project site when available. Bio-based content minimum 100 percent. Wood cellulose fiber processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to facilitate visual metering of application.
 - a. Straw for Lawn Seed Bed Mulch: Stalks from oats, wheat, rye, barley, or rice free of noxious weeds, mold or other objectionable material. Air dried and suitable for placing with blower equipment.
 - b. Wood Cellulose Fiber for Hydraulic Application of Grass Seed and Fertilizer: Specially prepared wood cellulose fiber, processed to contain no growth or germination-inhibiting factors, and dyed an appropriate color to facilitate visual metering of application of materials. Maximum 12 percent moisture dry weight, plus or minus 3 percent at time of manufacture. pH ranges from 3.5 to 5.0. Manufacture wood cellulose fiber for application as follows:
 - 1) After addition and agitation in slurry tanks with fertilizers, grass seeds, water, and other approved additives, fibers will become uniformly suspended to form a homogeneous slurry.
 - 2) When hydraulically sprayed, material will form blotter-like cover impregnated uniformly with grass seed.

- 3) Cover will allow absorption of moisture and allow rainfall or applied water to percolate to underlying soil.

2. Color: Natural.

- B. Compost Mulch: Decomposed organic matter with low carbon to nitrogen ratio.

2.10 ANTIDESICCANT

- A. Antidesiccant: An emulsion specifically manufactured for agricultural use that will provide protective film over plant surfaces permeable enough to permit transpiration.

2.11 EROSION CONTROL

- A. Erosion Control Blankets: 100 percent agricultural straw stitched with degradable nettings, designed to degrade within 12 months.
- B. Erosion Control Fabric: Knitted construction of polypropylene yarn with uniform mesh openings 3/4- to 1-inch square with strips of biodegradable paper. Minimum filler paper strip life of 6 months.
- C. Erosion Control Net: Heavy, twisted jute mesh weighing approximately 1.22 pounds per linear yard and 4 feet wide with mesh openings approximately 1 inch square.
- D. Erosion Control Material Anchors: As recommended by erosion control material manufacturer.

2.12 BIOSTIMULANTS

- A. Biostimulants: Formulation containing soil conditioners, VAM fungi, and endomycorrhizal and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions.

2.13 STAKING AND GUYING MATERIALS

- A. Staking Material:

1. Tree Support Stakes: Rough sawn hardwood free of knots, rot, cross grain, bark, long slivers, or other defects that impair strength. Minimum 2 inches square by 8 feet long, pointed at 1 end.
2. Ground Stakes: 2 inches square by 3 feet long wood or plastic, pointed at 1 end.

- B. Guying Material:

1. Guying Wire: ASTM A580/A580M, galvanized steel wire.
2. Guying Cable: Minimum 5-strand, 3/16-inch galvanized steel cable.

- C. Hose Chafing Guards: New or used 2 ply, 3/4-inch reinforced rubber or plastic hose, black or dark green, all of same color.
- D. Flags: White surveyor's plastic tape, 6 inches long, fastened to guying wires or cables.
- E. Turnbuckles: Galvanized or cadmium-plated steel with minimum 3-inch-long openings fitted with screw eyes and galvanized or cadmium-plated steel eye bolts with 1-inch-diameter eyes and 1-1/2-inch-minimum screw length.

2.14 TREE WRAP

- A. Crinkled Paper Tree Wrap: Two thicknesses of crinkled paper cemented together with layer of bituminous material. Minimum 4 inches wide with stretch factor of 33-1/3 percent. Tie with lightly tarred medium or coarse sisal yarn twine.
- B. Tree Shelters: Extruded, translucent, twin walled polypropylene protection board sheets, 1/8-inch thick, 6 feet long, utilized for short trunk trees 3-inch caliper or less.
- C. Synthetic Fabric Tree Wrap: White, breathable polypropylene fabric in 3-inch-wide rolls.
- D. Tape: Bio-degradable tape suitable for nursery use to secure tree wrap which degrades in sunlight maximum 2 years after installation.

2.15 TACKIFIERS AND ADHESIVES

- A. Non-asphalt Tackifier: Colloidal liquid fixative recommended by fiber mulch manufacturer for hydroseeding.
- B. Asphalt emulsion: ASTM D977, Grade SS-1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no materials that would inhibit plant growth are present in planting area. If such materials are present, remove soil and contaminants and provide new planting soil.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations if soil moisture becomes excessive. Resume soil preparations when moisture content returns to acceptable level.
 - 4. If soil is excessively dry, not workable, and too dusty, moisten uniformly.

5. Special conditions may exist that warrant variance in specified planting dates or conditions. Submit written request to Landscape Architect stating special conditions and proposed variance.

- B. Proceed with planting operations only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect existing and proposed landscape features, elements, site construction and completed work from damage. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on Drawings.
- B. Install erosion control materials at all areas inside or outside limits of construction that are disturbed by planting operations. Provide erosion control and seeding with native plant species to protect slopes.
- C. Stake out approved plant material locations and planter bed outlines on Project site before digging plant pits or beds. Landscape Architect reserves the right to adjust plant material locations to meet field conditions. Do not plant closer than 36 inches to building wall, pavement edge, fence or wall edge, and other similar structures. Provide onsite locations for excavated rock, soil, and vegetation.

3.3 PLANT BED PREPARATION

- A. Verify location of underground utilities before excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings. Where planting beds occur in existing turf areas, remove turf to depth that will ensure removal of entire root system. Measure depth of plant pits from finished grade. Provide depth of plant pit excavation and relation of top of root ball and finish grade as indicated on Drawings. Do not plant trees within 10 feet of any utility lines or building walls.
- B. For newly graded subgrades, loosen subgrade to minimum 6 inches deep. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off property.
 1. Apply fertilizer, lime, and soil amendments directly to subgrade before loosening, at rates recommended by soils analysis.
 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 3. Spread planting soil 6 inches deep but minimum 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 1/2 thickness of planting soil over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

- b. Reduce elevation of planting soil to allow for soil thickness of sod.
- C. Finish grade planting areas to smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2-inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in immediate future.

3.4 GROUND COVER AND PLANT INSTALLATION

- A. Place ground cover and plants, not including trees, shrubs, and vines, as indicated on Drawings in even rows and with triangular spacing.
- B. Use prepared soil mixture for backfill.
- C. Place so roots are in natural position.
- D. Do not remove plants from flats or containers until immediately before planting. Plant at depth to sufficiently cover all roots. Start watering areas planted as required by temperature and wind conditions. Water plants at sufficient rate to ensure thorough wetting of soil to 6 inches deep without runoff or puddling. Smooth planting areas after planting to provide even, smooth finish.
- E. Plant ground cover in areas to receive erosion control materials through material after erosion control materials are in place.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Move plant materials only by supporting root ball or container. Set trees on undisturbed site soil (do not over excavate) and plants on hand compacted layer of prepared backfill soil mixture 6 inches thick and hold plumb in center of pit until soil has been tamped firmly around root ball.
- B. Set plant materials in relation to surrounding finish grade 1 to 2 inches above depth at which they were grown in nursery, collecting field, or container. For trees, ensure root flare is visible before setting depth. Replace plant material whose root balls are cracked or damaged either before or during planting process.
- C. Place backfill soil mixture on previously scarified subsoil to completely surround root balls and bring to smooth and even surface, blending into existing areas.
- D. Balled and Burlapped Stock: Backfill with topsoil to approximately half ball depth then tamp and water. Carefully remove or fold back excess burlap and tying materials from top to minimum 1/3 depth from top of root ball. Tamp and complete backfill, place mulch topdressing, and water. Remove wires and non-biodegradable materials from plant pit before backfilling.

3.6 MECHANIZED TREE SPADE PLANTING

- A. At designated locations and with approved equipment, trees may be planted by mechanized tree spade. Tree spade is not acceptable for moving trees that are larger than maximum size of similar field-grown, balled-and-burlapped root-ball diameter recommended by ANSI Z60.1, or that are larger than manufacturer's recommended maximum size for tree spade to be used, whichever is smaller.
- B. For tree extraction, center trunk in tree spade and move tree and solid root ball.
- C. Cut any exposed roots with sharp instruments.
- D. Excavate planting hole with same tree spade used to extract and move tree.
- E. If possible, place trees with same orientation as at location from which they were extracted.

3.7 TREE WRAP

- A. Wrap deciduous tree trunks immediately after planting. Wrap tree trunks 1-1/2 inches or greater in caliper with specified material beginning at base and extending to lowest branches. Remove tree wrap after 1 year. Securely tie crinkled paper wrap with twine at top and bottom and at maximum 18-inch intervals.

3.8 TREE AND SHRUB PRUNING

- A. Pruning: Performed by trained and experience personnel according to TCIA A300P1.
- B. Remove dead and broken branches. Prune only to correct structural defects.
- C. Retain typical growth shape of individual plants with as much height and spread as practical. Do not central leader on trees. Make cuts with sharp instruments. Do not flush cut with trunk or adjacent branches. Collars shall remain in place.
- D. Do not apply tree wound dressing to cuts.

3.9 STAKING AND GUYING

- A. Staking: Stake plants with number of stakes indicated on Drawings with double strand of guy wire. Attach guy wire at half tree trunk height but maximum 5 feet high. Drive stakes to depth of 2-1/2 to 3 feet into the ground outside plant pit. Do not injure root ball. Install hose chafer guards where wire is in contact with tree trunk.
- B. Guying: Guy plants as indicated on Drawings. Attach 2 strands of guy wire around tree trunk at 45 degrees at half tree trunk height. Install hose chafer guards where wire is in contact with tree trunk. Anchor guys to ground stakes. Fasten flags to each guying wire at 2/3 of the distance above ground level. Provide turnbuckles as indicated on Drawings.

3.10 ROOT CONTROL BARRIER INSTALLATION

- A. At trees planted within 48 inches of paving, walls, curbs, and walkways, install root control barrier, unless otherwise shown on Drawings.
- B. Install geotextile fabric in soil for vertical, horizontal and surrounding application with appropriate holding device to ensure fabric position. For vertical and horizontal application, provide minimum 2-inch soil cover over top edge. Extend fabric minimum 18 inches beyond structure area to be protected to prevent root growth around fabric edges.
- C. Install polypropylene barrier minimum 1 inch above finished grade to prevent root growth over barrier. Backfill outside barrier with 3/4- to 1 inch of gravel for minimum 2 inches. For linear application, use device recommended by barrier manufacturer to connect 2 pieces.

3.11 MULCH INSTALLATION

- A. Provide specified mulch over entire planting bed surfaces and individual plant surfaces, including earth mount watering basin around plants, to 3 inches depth after plant installation and before watering. Do not place mulch in crowns of shrubs. Place mulch minimum 2 to 3 inches away from tree or shrub trunks. Place mulch on all weed control fabric.

3.12 EDGING INSTALLATION

- A. Uniformly edge beds of plants to provide clear cut division line between planted area and adjacent lawn. Construct bed shapes as indicated on Drawings.
- B. Natural Cut Edging: Provide uniform 'V' cut with 1 vertical side adjacent to turf areas 5 inches deep and second side angled 10 inches toward center of plant bed for clear cut division line between plant bed and adjacent lawn.

3.13 PLANT MAINTENANCE

- A. Frequency: Begin maintenance immediately after plants have been installed. Inspect plants at least once a week and perform required maintenance promptly.
- B. Promotion of Plant Growth and Vigor: Water, prune, fertilize, mulch, eradicate weeds, and perform other operations necessary to promote plant growth and vigor.
- C. Planter Beds: Weed, fertilize, and irrigate planter beds and keep pest free, pruned, and mulch levels maintained. Do not permit planter beds encroach into turf areas. Maintain edging breaks between turf areas and planter beds. Fertilize plant materials to promote healthy growth without encouraging excessive top foliar growth. Remove noxious weeds common to area from planter beds by mechanical means.

- D. Shrubs: In addition to planter bed maintenance requirements, selectively prune and shape shrubs for health and safety when the following conditions exist:
 - 1. Remove growth in front of windows, over entrance ways or walks, and any growth which will obstruct vision at street intersections or of security personnel.
 - 2. Remove dead, damaged, or diseased branches or limbs where shrub growth obstructs pedestrian walkways, where shrub growth is growing against or over structures, and where shrub growth permits concealment of unauthorized persons.
 - 3. Properly dispose of all pruning debris.
- E. Trees: Adjust stakes, ties, guy supports and turnbuckles and water, fertilize, control pests, mulch, and prune for health and safety
 - 1. Fertilize trees to promote healthy plant growth without encouraging excessive top foliar growth. Inspect and adjust stakes, ties, guy supports and turnbuckles to avoid girdling and promote natural development.
 - 2. Selectively prune all trees within Project boundaries, regardless of caliper, for safety and health reasons, including, but not limited to, removal of dead and broken branches and correction of structural defects. Prune trees according to their natural growth characteristics leaving trees well shaped and balanced.
 - 3. All pruning, including palm tree pruning, must be by or in presence of certified member of International Society of Arboriculture and according to TCIA Z133.1.
 - 4. Properly dispose of all pruning debris.

3.14 SLOPE EROSION CONTROL MAINTENANCE

- A. Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped and natural growth areas. Maintenance tasks include immediate repairs to weak spots in sloped areas, and maintaining clean, clear culverts and graded berms and terraces to intercept and direct water flow to prevent development of large gullies and slope erosion and securing irrigation systems during periods of extended rainfall.
 - 1. Fill eroded areas with amended topsoil and replant with same plant species.
 - 2. Reinstall erosion control materials damaged due to slope erosion.

3.15 REMOVAL OF DYING OR DEAD PLANTS

- A. Remove dead and dying plants immediately and provide new plants upon commencement of specified planting season and replace stakes, guys, mulch, and eroded earth mound water basins. No additional correction period will be required for replacement plants beyond original warranty period. Plants will be considered dead or dying as follows:
 - 1. Tree: Main leader die-back or minimum 20 percent of crown died.
 - 2. Shrub and Ground Cover: Minimum 20 percent of plant died.
 - 3. Determination: Scrape on maximum 1/16-inch square branch area to determine dying plant material cause and provide recommendations for replacement.

3.16 LANDSCAPE PLANT ACCEPTANCE

- A. Landscape plant and turfgrass acceptance will occur after completion of Landscape Plant Establishment Period. Contractor shall have completed, located, and installed all plants and turfgrass according to Drawings and Specifications. All plants and turfgrass are expected to be living and in healthy condition at time of inspection and acceptance. Make written request 2 weeks before final inspection of landscape plants and turfgrass. Upon inspection, when work is found to not meet Specifications, Establishment Period will be extended at no additional cost until work has been satisfactorily completed, inspected and accepted.
- B. Criteria for Acceptance of Landscape Plants:
 - 1. Tree support stakes, guys, and turnbuckles are in good condition.
 - 2. Total plants on site as required by Specifications and required replacements have been installed.
 - 3. Remedial measures have been completed.

3.17 CLEANING

- A. Remove and legally dispose of all excess soil and planting debris.

3.18 PROTECTION

- A. Protect plants from traffic and construction operations.
- B. Provide temporary fences or enclosures and signage, at planted areas. Maintain fences and enclosures during maintenance period.
- C. Remove protective materials immediately before acceptance.
- D. Repair damage.

END SECTION 329000

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

SECTION 329223 - SEEDING AND SODDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Refer to City of Lee's Summit, Missouri standard specification "LS Section 2400 – Seeding and Sodding" for sodding requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END SECTION 329223

SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for site water lines, including domestic water lines and fire water lines.
2. Tapping sleeves and valves.
3. Valves and boxes.
4. Fire hydrants.
5. Reduced-pressure backflow preventers.
6. Bedding and cover materials.

B. Related Requirements:

1. Section 310513 "Soils for Earthwork."
2. Section 310516 "Aggregates for Earthwork."
3. Section 312316 "Excavation."
4. Section 312323 "Fill."

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-pound Rammer and an 18-inch Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
3. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:

1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
4. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
5. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
6. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
8. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C200 - Steel Water Pipe, 6 Inches and Larger.
6. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe.
7. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inches and Larger - Shop Applied.
8. AWWA C206 - Field Welding of Steel Water Pipe.
9. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 Inches Through 144 Inches.
10. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
11. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
12. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
13. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
14. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
15. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
16. AWWA C606 - Grooved and Shouldered Joints.
17. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches Through 12 Inches, for Water Transmission and Distribution.
18. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2-Inch Through 3 Inches for Water Service.
19. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 Inches Through 63 Inches, for Waterworks.

F. American Welding Society:

1. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

H. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.
- B. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, valves, hydrants, and any other required information as requested by the engineer.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- E. Qualifications Statements: Submit qualifications for manufacturer and installer.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017000 "Execution and Closeout Requirements" for requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

- A. Valves: Mark valve body with manufacturer's name and pressure rating.
- B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.
- C. Perform Work according to the City of Lee's Summit, Missouri Standard Specifications Section 3900.
- D. Maintain 1 copy of each standard affecting Work of this Section on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum 3 years' documented experience in installation of Work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 "Product Requirements" for requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to manufacturer's instructions.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Do not place pipe or pipe materials in areas obstructing pedestrian or vehicle traffic.
 - 4. Store PE and PVC materials out of sunlight.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer's instructions.

1.8 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

- A. Section 017000 "Execution and Closeout Requirements" for requirements for warranties.
- B. Furnish 5-year manufacturer's warranty for valves.

PART 2 - PRODUCTS

2.1 PIPING

- A. Ductile Iron Pipe: Comply with City of Lee's Summit, Missouri Standard Specifications Section 3900.
- B. Copper Tubing: Comply with City of Lee's Summit, Missouri Standard Specifications Section 3900.
- C. PVC Pipe:
 - 1. Comply with AWWA C900, Class 235.
 - 2. Comply with City of Lee's Summit, Missouri Standard Specifications Section 3900.

2.2 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves: Furnish materials according to the City of Lee's Summit, Missouri Standard Specifications Section 3900 and the City of Lee's Summit, Missouri Water Utilities Department Approved Products List.
- B. Tapping Valves: Furnish materials according to the City of Lee's Summit, Missouri Standard Specifications Section 3900 and the City of Lee's Summit, Missouri Water Utilities Department Approved Products List.

2.3 VALVES, VALVE BOXES, AND HYDRANTS

- A. Furnish materials according to the City of Lee's Summit, Missouri Standard Specifications Section 3900 and the City of Lee's Summit, Missouri Water Utilities Department Approved Products List.

2.4 REDUCED-PRESSURE BACKFLOW PREVENTERS

- A. Furnish materials according to the City of Lee's Summit, Missouri Standard Specifications Section 3900 and the City of Lee's Summit, Missouri Water Utilities Department Approved Products List.

2.5 CONCRETE ENCASEMENT AND CRADLES

- A. Comply with City of Lee's Summit, Missouri Standard Specifications Section 3900.

2.6 MATERIALS

- A. Bedding and Cover: Comply with City of Lee's Summit, Missouri Standard Specifications Section 3900.

2.7 ACCESSORIES

- A. Comply with City of Lee's Summit, Missouri Standard Specifications Section 3900.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation examination.
- B. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.
- E. Protect and support existing distribution piping and appurtenances as Work progresses.

3.3 INSTALLATION

- A. Bedding: Excavate pipe trench and place bedding as specified in City of Lee's Summit, Missouri Standard Specifications Section 3900.
- B. Pipe and Fittings: Install Work according to City of Lee's Summit, Missouri Standard Specifications Section 3900.
- C. Disinfection: As specified in City of Lee's Summit, Missouri Standard Specifications Section 3900.

3.4 TOLERANCES

- A. Section 014000 "Quality Requirements" for requirements for tolerances.
- B. Install pipe within tolerances set forth by City of Lee's Summit, Missouri Standard Specifications Section 3900.

3.5 FIELD QUALITY CONTROL

- A. Section 017000 "Execution and Closeout Requirements" for requirements for testing, adjusting, and balancing.
- B. Testing:
 - 1. Perform acceptance testing on site water distribution piping in accordance with City of Lee's Summit, Missouri Standard Specifications Section 3900.
 - 2. Compaction Testing: Comply with the City of Lee's Summit, Missouri Standard Specifications Section 3900.

END OF SECTION 331416

SECTION 333100 - SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewerage piping.
2. Bedding and cover materials.

B. Related Requirements:

1. Section 003132 "Geotechnical Data."
2. Section 310513 "Soils for Earthwork."
3. Section 310516 "Aggregates for Earthwork."
4. Section 312316 "Excavation."
5. Section 312323 "Fill."

1.2 DEFINITIONS

- A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 10-pound Rammer and a 18-inch Drop.

B. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153 - Ductile-Iron Compact Fittings.

C. ASTM International:

1. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

2. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
3. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
5. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
6. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
7. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
8. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
9. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
10. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
11. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
12. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
13. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
14. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.4 COORDINATION

- A. Section 013000 "Administrative Requirements" for requirements for coordination.
- B. Coordinate Work of this Section with termination of sanitary sewer connection outside building, connection to City of Lee's Summit, Missouri utility service, and trenching.

1.5 PREINSTALLATION MEETINGS

- A. Section 013000 "Administrative Requirements" for requirements for preinstallation meeting.
- B. Convene minimum 1 week prior to commencing Work of this Section.

1.6 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.

- B. Product Data: Submit manufacturer information indicating pipe material to be used, pipe accessories, and any other information requested to be provided by the engineer or testing agency.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Source Quality-Control Submittals: Indicate results of tests and inspections.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement: Submit qualifications for manufacturer and installer.

1.7 CLOSEOUT SUBMITTALS

- A. Section 017000 "Execution and Closeout Requirements" for requirements for submittals.
- B. Project Record Documents: Record finished locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.8 QUALITY ASSURANCE

- A. Perform Work according to City of Lee's Summit, Missouri Standard Specifications Section 3500.
- B. Maintain 1 copy of each standard affecting Work of this Section on site.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum 3 years' documented experience and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 "Product Requirements" for requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:

1. Store materials according to manufacturer instructions.
2. Store valves in shipping containers with labeling in place.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Block individual and stockpiled pipe lengths to prevent moving.
3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SANITARY SEWERAGE PIPING

- A. Ductile-Iron Pipe: Comply with the City of Lee's Summit, Missouri Standard Specifications Section 3500.
- B. Polyvinyl Chloride (PVC) Pipe: Comply with the City of Lee's Summit, Missouri Standard Specifications Section 3500.

2.2 MANHOLES

- A. Comply with the City of Lee's Summit, Missouri Standard Specifications Section 3500.

2.3 FLEXIBLE COUPLINGS

- A. Furnish materials according to City of Lee's Summit, Missouri Standard Specifications Section 3500.

2.4 MATERIALS

- A. Bedding and Cover: Comply with the City of Lee's Summit, Missouri Standard Specifications Section 3500.

2.5 MIXES

- A. Grout: In accordance with City of Lee's Summit, Missouri Standard Specifications Section 3500.

2.6 SOURCE QUALITY CONTROL

- A. Section 014000 "Quality Requirements" for requirements for testing, inspection, and analysis.
- B. Provide shop inspection and testing of pipe.
- C. Owner Inspection:
 - 1. Make completed pipe sections available for inspection at manufacturer's factory prior to packaging for shipment.
 - 2. Notify Owner at least 7 days before inspection is allowed.
- D. Owner Witnessing:
 - 1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
 - 2. Notify Owner at least 7 days before inspections and tests are scheduled.
- E. Certificate of Compliance:
 - 1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
 - 2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation examination.
- B. Verify that trench cut is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings and per the City of Lee's Summit, Missouri Standard Specifications Section 3500.

3.2 PREPARATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation preparation.

- B. Correct over-excavation per the City of Lee's Summit, Missouri Standard Specifications Section 3500.
- C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- D. Protect and support existing sewer lines, utilities, and appurtenances.
- E. Utilities:
 - 1. Maintain profiles of utilities.
 - 2. Coordinate with other utilities to eliminate interference.
 - 3. Notify Architect/Engineer if crossing conflicts occur.

3.3 INSTALLATION

- A. Perform in accordance with the City of Lee's Summit, Missouri Standard Specifications Section 3500.

3.4 TOLERANCES

- A. Section 014000 "Quality Requirements" for requirements for tolerances.
- B. Maximum Variation from Indicated Slope: Per the City of Lee's Summit, Missouri Standard Specifications Section 3500.

3.5 FIELD QUALITY CONTROL

- A. Section 017000 "Execution and Closeout Requirements" for requirements for testing, adjusting, and balancing.
- B. Testing:
 - 1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
 - 2. Perform testing on site sanitary sewage system according to the City of Lee's Summit, Missouri Standard Specifications Section 3500.
 - 3. Compaction Testing: Comply with the City of Lee's Summit, Missouri Standard Specifications Section 3500.

3.6 PROTECTION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for protecting finished Work.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
- C. Cap open ends of piping during periods of Work stoppage.

END OF SECTION 333100

SECTION 334200 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stormwater drainage piping.
2. Manholes.
3. Catch basins.
4. Bedding and cover materials.

B. Related Requirements:

1. Section 003132 "Geotechnical Data."
2. Section 310513 "Soils for Earthwork."
3. Section 310516 "Aggregates for Earthwork."
4. Section 312316 "Excavation."
5. Section 312323 "Fill."

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
2. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
3. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
4. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
5. ASTM F2881 - Standard Specification for 12- to 60-Inch Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications.

1.3 COORDINATION

A. Section 013000 "Administrative Requirements" for requirements for coordination.

B. Coordinate Work of this Section with termination of storm sewer connection outside building, trenching, connection to foundation drainage system, and connection of storm sewer system to public sewer system.

1.4 PREINSTALLATION MEETINGS

- A. Section 013000 "Administrative Requirements" for requirements for preinstallation meeting.
- B. Convene minimum 1 week prior to commencing Work of this Section.

1.5 SUBMITTALS

- A. Section 013300 "Submittal Procedures" for requirements for submittals.
- B. Product Data: Submit manufacturer information describing pipe, pipe accessories, and any other information requested to be provided by the engineer or testing agency.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special procedures required to install specified products.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- F. Qualifications Statement: Submit qualifications for manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017000 "Execution and Closeout Requirements" for requirements for submittals.
- B. Project Record Documents: Record actual locations of pipe runs, connections, catch basins, area inlets, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.
- B. Maintain 1 copy of each standard affecting Work of this Section on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 3 years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 "Product Requirements" for requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

- A. Field Measurements:
 - 1. Verify field measurements prior to fabrication.
 - 2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 STORM DRAINAGE PIPING

- A. HDPE Piping: ADS N-12 or approved equal.
- B. Corrugated Polypropylene (PP) Piping, Dual Wall:
 - 1. Pipe: Comply with City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

2.2 MANHOLES

- A. As specified in City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

2.3 CATCH BASINS

- A. As specified in City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.
- B. As specified by catch basin manufacturer.

2.4 MATERIALS

- A. Bedding and Cover: Comply with City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

2.5 MIXES

- A. As specified in City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

2.6 FINISHES

- A. As specified in City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

2.7 ACCESSORIES

- A. As specified in City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 "Execution and Closeout Requirement" for requirements for installation examination.
- B. Verify that trench cut is ready to receive Work of this Section.
- C. Verify that excavations, dimensions, and elevations are per City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

3.2 PREPARATION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for installation preparation.
- B. Correct over-excavation per City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.
- C. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

- A. Perform in accordance with City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.
- B. Perform per manufacturer's requirements.

3.4 TOLERANCES

- A. Section 014000 "Quality Requirements" for requirements for tolerances.
- B. Maximum Variation from Indicated Pipe Slope: Per City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

3.5 FIELD QUALITY CONTROL

- A. Section 017000 "Execution and Closeout Requirements" for requirements for testing, adjusting, and balancing.
- B. Testing:
 - 1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
 - 2. Perform testing on site stormwater conveyance system as required by the City of Lee's Summit, Missouri.
 - 3. Compaction Testing: Comply with the City of Lee's Summit Standard Specifications Section 2600 and the Kansas City Metropolitan Chapter of the American Public Works Association Construction and Materials Specification Section 2600.

City of Lee's Summit
Fire Station
Lee's Summit, Missouri

3.6 PROTECTION

- A. Section 017000 "Execution and Closeout Requirements" for requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 334200