Project Manual

August 18, 2025
STANTEC Project No. 21400 1269

Elementary School No. 23

Alvin Independent School District
Manvel, Texas

Final Construction Documents

VOL. 1 of 2

All required permits must be obtained before construction

rear cover

SECTION 00 01 01 - TITLE PAGE:

TITLE AND LOCATION OF THE WORK:

ELEMENTARY SCHOOL #23
2727 White Gold Drive
Rosharon, Texas 77583

NAME AND ADDRESS OF THE OWNER:

ALVIN INDEPENDENT SCHOOL DISTRICT
301 East House Street
Alvin, Texas 77511

NAME AND ADDRESS OF THE ARCHITECT and CONSULTANTS:

STANTEC
ARCHITECT
910 Louisiana Street, Suite 2600
Houston, Texas 77002
Ph (713) 548-5700

S&G Engineers
CIVIL ENGINEER
1796 Avenue D, Suite B
Katy, Texas 77493
Ph (832) 437-7377

CMTA ENGINEERING CONSULTANTS
MEP, TECHNOLOGY & FIRE PROTECTION
2201 Timberloch Place
The Woodlands, Texas 77380
Ph (281) 419-9899

PEA Group
LANDSCAPE ARCHITECT
16060 Dillard Drive, Suite 250.
Houston, Texas 77040
Ph (713) 688-3530

STANTEC
STRUCTURAL ENGINEER
910 Louisiana Street, Suite 2600
Houston, Texas 77002
Ph (713) 548-5700

FOODSERVICE DESIGN PROFESSIONALS
FOOD SERVICE CONSULTANT
594 Sawdust Road, Suite 139
The Woodlands, Texas 77380
Ph (281) 350-2323

TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
CONTRACT DOCUMENTS

DOCUMENT 00 01 10 – MASTER TABLE OF CONTENTS

Note: This Master Table of Contents includes **all** specification sections for the Project regardless of origin. Sections marked by asterisk (*****) below are provided by consultants to the Architect or Owner and are not covered by the Architect's seal. Refer to attached supporting Tables of Contents to identify Consultant responsible for a particular section.

VOLUME 1 of 2

Section	Title
00 01 01	Project Title Page
00 01 10	Master Table of Contents
*00 01 11	Sealed Structural Table of Contents
*00 01 12	Sealed MEP Table of Contents
*00 01 13	Sealed Civil Table of Contents
*00 01 14	Sealed Landscape Table of Contents
00 01 15	List of Drawings – Reference Drawing Sheet **G002**

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS - for Competitive Sealed Proposals (CSP)

*00 01 16	Invitation to Proposers
*00 22 13	Supplementary Instructions to Proposers and Attached Forms
*00 23 13	Ranking Criteria for Competitive Sealed Proposals (CSP)
*00 31 32	Geotechnical Data
00 41 00	Proposal Form (Base & Unit Prices)
00 41 10	Proposal Form (Alternates Proposals)
00 43 13	Proposal Security
00 50 00	Construction Contract and Conditions
00 60 00	Bonds and Certificates
*00 73 00	Supplementary Conditions
*00 73 43	Wage Rates

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	Summary of Work and Scheduling
01 21 00	Cost Allowances
01 22 00	Unit Prices
01 23 00	Alternates
01 25 13	Product Substitutions
01 26 00	Contract Modification Procedures
01 29 00	Applications for Payment
01 30 00	Administrative Requirements
01 30 10	Mechanical and Electrical Coordination
01 31 19	Project Meetings
01 32 00	Notification of Architect Requirements
*01 32 23	Survey and Layout Data
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 42 19	Reference Standards and Definitions
01 50 00	Temporary Facilities
*01 55 13.10	Stabilized Construction Access
*01 55 26	Traffic Control
*01 57 10	TPDES Requirements
*01 57 19	Temporary Environmental Controls
*01 57 23	Temporary Storm Water Pollution Control
01 60 00	Product Requirements
01 70 00	Execution and Closeout Procedures

01 73 29 Cutting and Patching
*01 74 16 Site Maintenance
*01 74 19 Construction Waste Management and Disposal
01 78 00 Warranties
*01 80 00 Special Owner Requirements
*01 91 13 General Commissioning Requirements
*01 91 14 Commissioning Authority Responsibilities

DIVISION 02 – EXISTING CONDITIONS
*02 41 13.10 Removing Existing Pavement and Structures

DIVISION 03 - CONCRETE
*03 30 00 Cast-In-Place Concrete
03 35 43 Special Concrete Floor Finishes
03 52 16 Insulating Concrete Roof Fill
*03 62 00 Non-Shrink Grout

DIVISION 04 - MASONRY
04 05 03 Masonry Mortaring and Grouting
04 20 00 Unit Masonry Assemblies
*04 29 00 Engineered Unit Masonry

DIVISION 05 - METALS
*05 12 00 Structural Steel Framing
*05 12 13 Architecturally Exposed Structural Steel
*05 21 00 Steel Joist Framing
*05 31 00 Steel Decking
*05 40 00 Cold-Formed Metal Framing
05 50 00 Metal Fabrications
05 51 00 Metal Stairs
05 52 00 Metal Railings

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
06 10 53 Miscellaneous Rough Carpentry
06 20 24 Interior Finish Carpentry and Millwork
06 42 19 Plastic Laminate Wall Panels
06 61 16 Solid Surfacing Fabrications
06 61 19 Quartz Surfacing Fabrications

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 13 00 Sheet Waterproofing
07 19 16 Concrete Floor Sealer and Finish
07 21 13 Thermal Wall Insulation
07 27 26 Fluid Applied Membrane Air Barrier
07 42 13 Metal Soffit Panels
07 54 23 Multiply PVC Kee Fleeceback Membrane Roofing
07 62 00 Sheet Metal Flashing and Trim
07 71 00 Roof Specialties
07 72 33 Roof Hatches
07 81 00 Applied Fireproofing
07 84 00 Firestopping
07 90 00 Joint Protection
07 95 00 Premanufactured Expansion Joint Systems

DIVISION 08 - OPENINGS

08 11 13	Standard Steel Doors and Frames
08 14 16	Flush Wood Doors
08 31 13	Access Doors and Frames
08 32 13	Sliding Aluminum-Framed Glass Doors
08 33 13	Overhead Counter Doors
08 33 23	Overhead Coiling Doors
08 34 73	Sound Control Door Assemblies
08 41 13	Aluminum-Framed Entrances and Storefronts
08 44 13	Glazed Aluminum Curtain Walls
08 45 00	Translucent Wall and Roof Assemblies
08 56 54	Ballistic Rated Transaction Windows
*08 71 00	Door Hardware
*08 74 00	Access Control Monitoring System
08 80 00	Interior Glazing
08 88 56	Ballistic and Impact-Resistant Glazing
08 91 00	Louvers

DIVISION 09 - FINISHES

09 21 16	Gypsum Board Assemblies
09 30 00	Tiling
09 51 13	Lay-In Acoustical Panel Ceilings
09 54 23	Linear Metal Ceiling System
09 64 13	Finish Wood Stage Steps
09 65 00	Resilient Flooring and Base
09 65 66	Resilient Athletic Flooring
09 66 23	Resinous Matrix Terrazzo Flooring – Alternate
09 68 16	Carpeting
09 72 00	Wall Coverings
09 72 16.16	Rigid Sheet Vinyl Wall Protection
09 77 00	FRP Wall Panels
09 77 23	Fabric Wrapped Wall Panels
09 90 00	Painting and Coating
09 96 53	Elastomeric Coatings

DIVISION 10 - SPECIALTIES

10 11 00	Visual Display Surfaces
10 14 00	Graphics Panels, Plaques, and Building Letters
10 14 26	Post and Panel Signs
10 21 15	Solid Plastic Toilet Compartments
10 26 41	Ballistic-Resistant Fiberglass Panels
10 28 00	Toilet Accessories
10 28 10	Miscellaneous Specialties
10 44 00	Fire Protection Specialties
10 51 13	Metal Wardrobe Lockers
10 73 26	Aluminum Walkway Covers and Canopies
10 75 00	Flags and Flagpoles

DIVISION 11 - EQUIPMENT

*11 40 00	Food Service Equipment
11 52 13	Projection Screens
11 61 43	Stage Curtains and Tracks
11 66 00	Athletic Equipment
11 66 24	Basketball Backstops
11 68 13	Playground Equipment and Structures

DIVISION 12 - FURNISHINGS
12 21 13 Horizontal Louver Blinds
12 32 16 Manufactured Plastic Laminate-Clad Casework
12 56 51 Manufactured Library Furniture
12 93 00 Site Furnishings

DIVISION 13 – NOT USED

DIVISION 14 – CONVEYING EQUIPMENT
14 24 01 Hydraulic Passenger Elevators

DIVISIONS 15 Through 20: Not Used

End of Master TOC Volume 1

VOLUME 2 of 2

Section	Title
00 01 01	Project Title Page
00 01 10	Master Table of Contents
*00 01 11	Sealed Structural Table of Contents
*00 01 12	Sealed MEP Table of Contents
*00 01 13	Sealed Civil Table of Contents
*00 01 14	Sealed Landscape Table of Contents

DIVISION 21 - FIRE SUPPRESSION

*21 01 00	Fire Protection General Requirements
*21 01 20	Fire Protection Shop Drawings and Submittals
*21 01 50	Fire Protection Materials and Methods
*21 05 53	Identification for Fire Suppression Piping and Equipment
*21 13 00	Fire Suppression Sprinkler Systems

DIVISION 22 - PLUMBING

*22 01 00	Plumbing General Requirements
*22 01 20	Plumbing Shop Drawings and Submittals
*22 01 50	Plumbing and Piping Materials and Methods
*22 05 29	Hangers and Supports for Plumbing Piping and Equipment
*22 05 53	Identification for Plumbing Piping and Equipment
*22 07 19	Plumbing Piping Insulation
*22 08 00	Commissioning of Plumbing
*22 10 05	Plumbing Piping
*22 10 06	Plumbing Piping Specialties
*22 13 23	Sanitary Waste Interceptors
*22 30 00	Plumbing Equipment
*22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

*23 01 00	Mechanical General Requirements
*23 01 20	Mechanical Shop Drawings and Submittals
*23 01 50	Mechanical Materials and Methods
*23 05 13	Common Motor Requirements for HVAC Equipment
*23 05 19	Meters and Gauges for HVAC Piping
*23 05 23	General Duty Valves for HVAC Piping
*23 05 29	Hangers and Supports for HVAC Piping and Equipment
*23 05 53	Identification for HVAC Piping and Equipment
*23 05 93	Testing, Adjusting, and Balancing for HVAC
*23 07 13	Duct Insulation
*23 07 16	HVAC Equipment Insulation
*23 07 19	HVAC Piping Insulation
*23 08 00	Commissioning of HVAC
*23 09 00	Instrumentation and Control for HVAC
*23 09 30	Kitchen Hood Ventilation Control System
*23 09 34	Variable Frequency Motor Controllers for HVAC
*23 09 93	Sequence of Operations for HVAC Controls
*23 21 13	Hydronic Piping

*23 21 14 Hydronic Specialties
*23 21 23 Hydronic Pumps
*23 23 00 Refrigerant Piping
*23 25 00 HVAC Water Treatment
*23 31 00 HVAC Ducts and Casings
*23 33 00 Air Duct Accessories
*23 34 23 HVAC Power Ventilators
*23 34 39 High Volume Low Speed Propeller Fans
*23 36 00 Air Terminal Units
*23 38 13 Commercial Kitchen Hoods
*23 38 13.01 Residential Kitchen Range Hood for Commercial Buildings
*23 51 00 Breechings, Chimneys, and Stacks
*23 52 16 Condensing Boilers
*23 64 23 Scroll Water Chillers
*23 73 13 Modular Indoor Central Station Air Handling Units

DIVISION 26 - ELECTRICAL
*26 01 00 Electrical General Requirements
*26 01 20 Electrical Shop Drawings and Submittals
*26 05 19 Low Voltage Electrical Power Conductors and CAbles
*26 05 26 Grounding and Bonding for Electrical Systems
*26 05 29 Hangers and Supports for Electrical Systems
*26 05 33.13 Conduit for Electrical Systems
*26 05 33.16 Boxes for Electrical Systems
*26 05 33.23 Surface Raceways for Electrical Systems
*26 05 36 Cable Trays for Electrical Systems
*26 05 53 Identification for Electrical Systems
*26 05 73 Power System Studies
*26 08 00 Commissioning of Electrical
*26 09 23 Lighting Control Devices
*26 21 00 Low Voltage Electrical Service Entrance
*26 22 00 Low Voltage Transformers
*26 24 13 Switchboards
*26 24 16 Panelboards
*26 27 26 Wiring Devices
*26 28 13 Fuses
*26 28 16.13 Enclosed Circuit Breakers
*26 28 16.16 Enclosed Switches
*26 29 13 Enclosed Controllers
*26 32 13 Engine Generators
*26 36 00 Transfer Switches
*26 36 33 Generator Docking Station
*26 43 13 Surge Protective Devices
*26 51 00 Interior Lighting
*26 56 00 Exterior Lighting

DIVISION 27 - COMMUNICATION
*27 00 00 Common Communications Requirements
*27 05 03 Communications Shop Drawings and Submittals
*27 05 10 Scope of the Communications Work
*27 05 29 Hangers and Supports for Communications Systems
*27 10 00 Structured Cabling Common Requirements
*27 11 00 Communications Equipment Room Fittings
*27 11 16 Communications Racks, Frames, and Enclosures

*27 13 23 Communications Optical Fiber Backbone Cabling
*27 15 13 Communications Copper Horizontal Cabling
*27 30 14 Voice Communication System for Elevators
*27 41 16 Integrated Audo Video Systems and Equipment – Common Requirements
*27 41 16.55 Integrated Audo Video Systems - Dining
*27 41 16.56 Integrated Audo Video Systems - Gymnasium
*27 41 23 Integrated Audo Cabling and Accessories
*27 51 23 Intercommunications and Program Systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
*28 00 00 Common Electronic Safety and Security Requirements
*28 05 03 Electronic Safety and Security Shop Drawings and Submittals
*28 05 10 Scope of the Electronic Safety and Security Work
*28 10 00 Access Control
*28 31 11 Intrusion Detection System
*28 46 00 Fire Detection and Alarm

DIVISIONS 29 & 30 – Not Used

DIVISION 31 - EARTHWORK
*31 00 00 Site Earthwork
*31 06 20.15 Cement Stabilized Sand
*31 06 20.17 Utility Backfill Materials
*31 11 00 Clearing and Grubbing
*31 22 00 Site Grading
*31 22 16 Fine Grading
*31 22 17 Topsoil
*31 23 15 Building Earthwork
*31 23 16.14 Trench Safety System
*31 23 33 Excavation and Backfill for Utilities
31 31 16 Termite Control
*31 63 29 Drilled Concrete Piers and Shafts

DIVISION 32 - EXTERIOR IMPROVEMENTS
*32 01 90 Operation and Maintenance of Planting
*32 11 13.13 Lime-Treated Subgrades
*32 11 29.13 Lime-Fly Ash-Treated Base Courses
*32 13 13.00 Concrete Paving
*32 13 13.13 Concrete Pavement Curing
*32 13 13.25 Concrete Sidewalks
32 13 17 Integrally Colored Decorative Concrete Paving
*32 13 73 Concrete Paving Joints and Sealants
*32 16 13 Curbs and Gutters
*32 17 23 Pavement Markings
32 18 16 Playground Protective Surfacing
32 31 13 Chain Link Fences and Gates
32 31 19 Decorative Metal Fences and Gates
32 31 25 Louvered Fencing and Gates
*32 84 00 Planting Irrigation
*32 91 13 Soil Preparation
*32 91 14 Planting Media
*32 92 00 Turf and Grasses
*32 92 13 Hydromulch Seeding
*32 93 00 Plants

DIVISION 33 – UTILITIES

*33 05 13 Manholes and Structures
*33 05 13.13 Manhole Grade Adjustment
*33 05 16.13 Precast Concrete Utility Structures
*33 05 16.16 Concrete for Utility Construction
*33 06 10.14 Polyvinyl Chloride (PVC) Pipe
*33 06 10.15 Ductile Iron Pipe and Fittings
*33 06 40.10 HDPE Solid and Profile Wall Pipe
*33 06 40.11 Reinforced Concrete Pipe
*33 11 00 Water Utility Distribution Piping
*33 12 13.10 Tapping Sleeves and Valves
*33 12 13.12 Wet Connections
*33 12 16 Water Utility Distribution Valves
*33 12 19 Water Utility Distribution Fire Hydrants
*33 12 40 Valve Boxes, Meter Boxes, and Meter Vaults
*33 13 00 Disinfecting of Water Utility Distribution
*33 13 00.10 Hydrostatic Testing of Pipelines
*33 31 00 Sanitary Utility Sewerage Piping
*33 31 00.10 Acceptance Testing for Sanitary Sewers
*33 41 00 Storm Utility Drainage Piping
*33 49 13 Storm Drainage Manholes, Frames, and Covers

End of Master TOC Volume 2

DOCUMENT 00 01 11 – STRUCTURAL TABLE OF CONTENTS

DIVISION 03 – CONCRETE
03 30 00 Cast-In-Place Concrete
03 62 00 Non-Shrink Grout

DIVISION 04 - MASONRY
04 29 00 Engineered Unit Masonry

DIVISION 05 - METALS
05 12 00 Structural Steel Framing
05 12 13 Architecturally Exposed Structural Steel
05 21 00 Steel Joist Framing
05 31 00 Steel Decking
05 40 00 Cold-Formed Metal Framing

DIVISION 31 – EARTHWORK
31 23 15 Building Earthwork
31 63 29 Drilled Concrete Piers and Shafts

2025.08.18

MEP TABLE OF CONTENTS

DIVISION 01 - GENERAL
01 91 13 General Commissioning Requirements
01 91 14 Commissioning Authority Responsibilities

DIVISION 21 - FIRE SUPPRESSION
21 00 00 Fire Protection General Requirements
21 01 20 Fire Protection Shop Drawings and Submittals
21 01 50 Fire Protection Materials and Methods
21 05 53 Identification for Fire Suppression Piping and Equipment
21 13 00 Fire Suppression Sprinkler Systems

DIVISION 22 - PLUMBING
22 01 00 Plumbing General Requirements
22 01 20 Plumbing Shop Drawings and Submittals
22 01 50 Plumbing and Piping Materials and Methods
22 05 29 Hangers and Supports for Plumbing Piping and Equipment
22 05 53 Identification for Plumbing Piping and Equipment
22 07 19 Plumbing Piping Insulation
22 08 00 Commissioning for Plumbing
22 10 05 Plumbing Piping
22 10 06 Plumbing Piping Specialties
22 13 23 Sanitary Waste Interceptors
22 33 00 Plumbing Equipment
22 40 00 Plumbing Fixtures

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING
23 01 00 Mechanical General Requirements
23 01 20 Mechanical Shop Drawings and Submittals
23 01 50 Mechanical Materials and Methods
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 19 Meters and Gages for HVAC Piping
23 05 23 General-Duty Valves for HVAC Piping
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing for HVAC
23 07 13 Duct Insulation
23 07 16 HVAC Equipment Insulation
23 07 19 HVAC Piping Insulation
23 08 00 Commissioning of HVAC
23 09 00 Instrumentation and Control for HVAC
23 09 30 Kitchen Hood Ventilation Control System
23 09 34 Variable Frequency Motor Controllers for HVAC
23 09 93 Sequence of Operations for HVAC Controls
23 21 13 Hydronic Piping
23 21 14 Hydronic Specialties
23 21 23 Hydronic Pumps

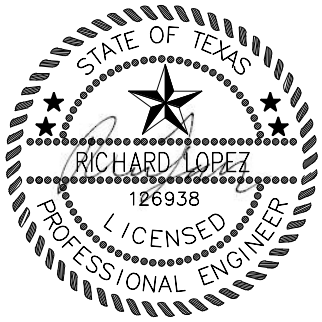
23 23 00 Refrigerant Piping
23 25 00 HVAC Water Treatment
23 31 00 HVAC Ducts and Casings
23 33 00 Air Duct Accessories
23 34 23 HVAC Power Ventilators
23 34 39 High Volume Low Speed Propeller Fans
23 36 00 Air Terminal Units
23 38 13.01 Residential Kitchen Range Hood for Commercial Buildings
23 38 13 Commercial Kitchen Hoods
23 51 00 Breeching, Chimneys, and Stacks
23 52 16 Condensing Boilers
23 64 23 Scroll Water Chillers
23 73 13 Modular Indoor Central-Station Air-Handling Units

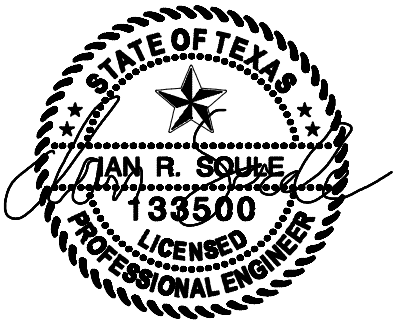
DIVISION 26 - ELECTRICAL
26 01 00 Electrical General Requirements
26 01 20 Electrical Shop Drawings and Submittals
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 29 Hangers and Supports for Electrical Systems
26 05 33.13 Conduit for Electrical Systems
26 05 33.16 Boxes for Electrical Systems
26 05 33.23 Surface Raceways for Electrical Systems
26 05 36 Cable Trays for Electrical Systems
26 05 53 Identification for Electrical Systems
26 05 73 Power System Studies
26 08 00 Commissioning of Electrical
26 09 23 Lighting Control Devices
26 21 00 Low Voltage Electrical Service Entrance
26 22 00 Low-Voltage Transformers
26 24 13 Switchboards
26 24 16 Panelboards
26 27 26 Wiring Devices
26 28 13 Fuses
26 28 16.13 Enclosed Circuit Breakers
26 28 16.16 Enclosed Switches
26 29 13 Enclosed Controllers
26 32 13 Engine Generators
26 36 00 Transfer Switches
26 36 33 Generator Docking Station
26 43 13 Surge Protective Devices
26 51 00 Interior Lighting
26 56 00 Exterior Lighting

DIVISION 27 - COMMUNICATION
27 00 00 Common Communications Requirements
27 05 03 Communications Shop Drawings and Submittals
27 05 10 Scope of the Communications Work

27 05 29 Hangers and Supports for Communications Systems
27 10 00 Structured Cabling Common Requirements
27 11 00 Communications Equipment room Fittings
27 11 16 Communications Racks, Frames, and Enclosures
27 13 23 Communications Optical Fiber Backbone Cabling
27 15 13 Communications Copper Horizontal Cabling
27 30 14 Voice Communication System for Elevators
27 41 16.00 Integrated Audio-Video Systems and Equipment – Common Requirements
27 41 16.55 Integrated Audio-Video Systems – Dining
27 41 16.56 Integrated Audio-Video Systems – Gymnasium
27 41 23 Audio-Video Cabling and Accessories
27 51 23 Intercommunications and Program Systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
28 00 00 Common Electronic Safety and Security Requirements
28 05 03 Electronic Safety and Security Shop Drawings and Submittals
28 05 10 Scope of the Electronic Safety and Security Work
28 10 00 Access Control
28 31 11 Intrusion Detection System
28 46 00 Fire Detection and Alarm





SECTION 00 01 13 – CIVIL TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

No. of Section	Title
01 32 23	Survey and Layout Data
01 55 13.10	Stabilized Construction Access
01 55 26	Traffic Control
01 57 10	TPDES Requirements
01 57 19	Temporary Environmental Controls
01 57 23	Temporary Storm Water Pollution Control
01 74 16	Site Maintenance
01 74 19	Construction Waste Management and Disposal

DIVISION 02 – EXISTING CONDITIONS

No. of Section	Title
02 41 13.10	Removing Existing Pavement and Structures

DIVISION 31 – EARTHWORK

No. of Section	Title
31 00 00	Site Earthwork
31 06 20.15	Cement Stabilized Sand
31 06 20.17	Utility Backfill Materials
31 11 00	Clearing and Grubbing
31 22 00	Site Grading
31 23 16.14	Trench Safety System
31 23 33	Excavation and Backfill for Utilities

DIVISION 32– EXTERIOR IMPROVEMENTS

No. of Section	Title
32 11 13.13	Lime-Treated Subgrades
32 11 29.13	Lime-Fly Ash-Treated Base Courses
32 13 13.00	Concrete Paving
32 13 13.10	Concrete Pavement Curing
32 13 13.25	Concrete Sidewalks
32 13 73	Concrete Paving Joints and Sealants
32 16 13	Curbs and Gutters
32 17 23	Pavement Markings

DIVISION 33 – UTILITIES

No. of Section	Title
33 05 13.00	Manholes and Structures
33 05 13.13	Manhole Grade Adjustment
33 05 16.13	Precast Concrete Utility Structures
33 05 16.16	Concrete for Utility Construction
33 06 10.14	Polyvinyl Chloride (PVC) Pipe
33 06 10.15	Ductile Iron Pipe and Fittings
33 06 40.10	HDPE Solid and Profile Wall Pipe
33 06 40.11	Reinforced Concrete Pipe
33 11 00	Water Utility Distribution Piping
33 12 13.10	Tapping Sleeves and Valves
33 12 13.12	Wet Connections
33 12 16	Water Utility Distribution Valves
33 12 19	Water Utility Distribution Fire Hydrants
33 12 40	Valve Boxes, Meter Boxes, and Meter Vaults
33 13 00.00	Disinfecting of Water Utility Distribution
33 13 00.10	Hydrostatic Testing of Pipelines
33 31 00.00	Sanitary Utility Sewerage Piping
33 31 00.10	Acceptance Testing for Sanitary Sewers
33 41 00	Storm Utility Drainage Piping
33 49 13	Storm Drainage Manholes, Frames and Covers

DOCUMENT 00 01 14 – LANDSCAPE TABLE OF CONTENTS

DIVISION 31 - EARTHWORK
31 22 16 Fine Grading
31 22 17 Topsoil

DIVISION 32 - EXTERIOR IMPROVEMENTS
32 01 90 Operation & Maintenance of Planting
32 84 00 Planting Irrigation
32 91 13 Soil Preparation
32 91 14 Planting Media
32 92 00 Turf and Grasses
32 92 13 Hydromulch Seeding
32 93 00 Plants

8/18/25

SECTION 00 01 16 - INVITATION TO PROPOSERS

PROJECT: **ELEMENTARY SCHOOL #23**
ALVIN INDEPENDENT SCHOOL DISTRICT

ARCHITECT'S PROJECT NUMBER: 214000 933

PROPOSAL DATE AND TIME: **TUESDAY, SEPTEMBER 16, 2025**
2:00 PM for Base Proposals and Unit Prices
3:00 PM for Alternates

ARCHITECT: STANTEC
910 Louisiana Street, Suite 2600
Houston, Texas 77002
(713) 548 5700
ATTN: Mark E. Jackson, AIA, LEED AP

PROPOSALS.

A. Base Proposal
   1. Includes all Work of the Project except for work described as "Alternates".
   2. Refer to 00 14 00 for the Base Proposal Form

B. Alternates and Unit Prices
   1. Alternates and Unit Prices will be separate individual proposed numbers
   2. Refer to 01 23 00 for brief description of Alternates
   3. Refer to 00 41 10 for the Alternates Proposal Form

C. Proposers are required to execute both the Proposal for Base Bid Work and the Proposal for Alternates Work. The Combination of the Base Proposal and any accepted Alternates Proposals be used by the District in making evaluations

1.2 RECEIPT AND OPENING OF PROPOSALS

A. Sealed Proposals for the above referenced project shall be received at the following location:
   Alvin Independent School District Support Services Center
   2200 Stapp Maxwell – Building A
   Alvin, Texas 77511

B. Proposals will NOT be accepted after designated time, according to the Owner's clock at the place of submittal.

C. Proposals shall be on a lump sum basis including General Contract, Electrical and Mechanical work. Proposals received after the date and time specified shall NOT be accepted. All Proposals will be opened and read aloud at **3:01 PM**.

D. The Owner invites Proposals on the form indicated in Section 00 41 00 for the above referenced project.

E. The Owner may consider informal any Proposal not prepared and submitted in accordance with the provisions. Any Proposal may be withdrawn prior to the scheduled time for the opening of Proposals or authorized postponement thereof. Any Proposal received after the time and date specified shall not be considered. No Proposer shall withdraw a Proposal within **thirty (30) calendar days** after the actual date of the opening thereof.

F. By execution and submission of a Proposal, the Proposer attests and affirms that their subcontractors are skilled and experienced in the use and interpretation of plans, specifications, addenda and related documents and, that they have carefully reviewed the plans, specifications, addenda and related documents for this project and has found them to be free of conflicts and/or ambiguities and sufficient for the purpose of submitting a Proposal, and for construction. Further, they have carefully examined the soils reports and the site of the work, and - through their own personal observations - has satisfied themselves as to the nature, location and requirements of the work; the character, quality and quantity of materials required; the difficulties likely to be encountered; the other items and/or conditions which may affect the satisfactory performance of the work. They have based their Proposal solely on these documents - and personal observations - and has not relied in any way on any explanation or interpretation - oral or written - from any source other than those written and issued by the Architect/Engineer.

G. Representations: by execution and submission of a Proposal, the Proposer hereby represents and warrants to the Owner as follows:
1. The Proposer has read and understands the Proposal documents and the Contract Documents and the Proposal is made in accordance with the Proposal Documents.

H. By submitting a Proposal, each Proposer agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees arising out of or in connection with the administration, evaluation, or recommendation of any Proposal; waiver of any requirements under the Proposal Documents, or the Contract Documents; and award of the Contract.

I. The Proposer agrees that the Owner has the right to accept or reject any or all Proposals and to waive all informalities.

1.3 CONTRACT DOCUMENTS

A. Copies of the Contract Documents may be obtained from the following reprographics company:

ARC Houston
4900 Dacoma Street
Houston, Texas 77092
https://www.e-arc.com/location/houston-dacoma-street/

B. Contract Documents may be examined at the following plan rooms:

1. F.W. Dodge, 10606 Hempstead Road, Suite 110, Houston, Texas 77092
281-460-5730 – Toni Lawson
2. Associated General Contractors, 3825 Dacoma, Houston, Texas 77092
800-364-2059 ext 7024 – Jake Valentine
3. Associated Builders and Contractors, 3910 Kirby Drive, Houston, Texas 77098
713-523-6222
4. Construction Market Data-Houston plan room, Houston, Texas
770-209-3814 – Pam Graham
5. Virtual Builders Exchange;
832-613-0201 ext 404 – Breanna Clark

C. Copies of documents or PDF files may also be purchased from the reprographics company

D. Proposal security in the amount of 5% of the largest possible total of Proposals submitted shall accompany each Proposal in accordance with the Instruction to Proposers.

E. Statutory Bonds for performance of the contract and for payments of mechanics and materials shall be required in an amount equal to 100% of the accepted Proposal.

F. The Owner reserves the right to hold all Proposals for **thirty (30)** calendar days from date of receipt without action, to reject any and all Proposals, to waive irregularities, and to require statements or evidence of Offerors qualifications including financial statements.

1.4 COMPLETION OF WORK

A. Completion of this Contract is of importance to the Owner. See Section 01 10 00 - Summary of Work for required completion dates. Note that milestone dates have been provided for major portions of the work, in addition to overall substantial completion date.

1.5 PRE-PROPOSAL CONFERENCE

A. As indicated in Section 00 22 13 - Supplementary Instructions.to Proposers, a Pre-Proposal Conference will be held at:

Alvin Independent School District Support Services Center
2200 Stapp Maxwell – Building A
Alvin, Texas 77511

Day & Time: September 9, 2025 at 10:00 AM

B. Interested parties are advised to monitor any issued addenda that may affect date, time, or location for this pre-proposal conference.

1.6 QUALIFICATIONS PACKAGES

A. All Proposers shall submit Qualifications Packages for the Owner’s evaluation in accordance with Section 00 23 13 – Ranking Criteria.

END OF SECTION

SECTION 00 22 13 - SUPPLEMENTARY INSTRUCTIONS TO PROPOSERS AND ATTACHED FORMS

The following sections modify or supplement the provisions of AIA Document A701, Instructions to Bidders:

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.4 PRE-PROPOSAL CONFERENCE: A Pre-Proposal Conference will be held at:

Alvin Independent School District Support Services Center
2200 Stapp Maxwell – Building A
Alvin, Texas 77511

Day & Time: Tuesday, September 9, 2025 at 10:00 AM

Attendance by representatives of the building contractors is highly desirable. Sub-Contractors who expect to be associated with the project are invited. Representatives of the Owner, Architect, Engineer, and Architect's Consultants will generally and briefly review and discuss the plans, specifications, details, materials, demolition, alterations and requirements of the Work with those interested parties present.

A written Addendum with a list of attendees and any changes in the Contract Documents will be issued subsequent to the Pre-Proposal Conference.

4.1.8 TIME OF COMPLETION

4.1.8.1 Time of completion of this Contract is of importance to the Owner and will be considered in the award of this Contract as well as future Contracts. Payments on the Contract shall be made as provided by the Contract. No payment shall be made on the Contract after 30 days prior to the completion date set by the Contractor, until final completion and acceptance by the Architect and Owner.

4.1.8.2 Extensions of time granted for causes described herein will be granted on the basis of one Regular Work Day extension for each Regular Work Day lost (i.e., 7 Calendar Days extension will be granted after 5 Regular Work Days are lost, except as modified by the provisions contained herein related to Anticipated Weather Days).

Each Proposer shall include in his proposed Contract Time an allowance of Anticipated Weather Days in accordance with the following schedule:

Number of Anticipated Weather Days to be included in proposed Contract Time (These are Regular Work Days) only in those months in which critical portions of the Work are being completed which can be impacted by weather:

January = 6	**April = 6**	**July = 4**	**October = 8**
February = 6	**May = 2**	**August = 4**	**November = 6**
March = 6	**June = 6**	**September = 8**	**December = 6**

The Contractor shall include within their contract an appropriate number of lost days due to average inclement or adverse weather conditions. Only weather-related days that exceed the 5 year average for the number of days with ½ inch or greater rainfall as measured by the National Weather Service for the greater Houston area will be granted as extra contract time. Only one mud day will accompany each rain day.

Weather Days shall pertain to such items as rain, flooding, snow, unusually high winds, excessively wet grounds, or the like which prevent progress on major portions of the Work on Regular Work Days only. If such situations occur on more than the number of Anticipated Weather Days included in the proposed Contract Time and if those additional days prevent the Contractor from performing critical portions of the scheduled Work, extensions of time caused by inclement weather may be requested as enumerated hereinafter;

At the beginning of each month, the Contractor shall submit a monthly status report showing (1) the scheduled number of Anticipated Weather Days for the particular month, (2) the actual Weather Days requested, and (3) the Net Weather Days (plus, minus, or no change). At times deemed appropriate by the Architect or when requested in writing by the Contractor, the Contract Time will be adjusted by Change Order if the total of Net Weather Days is substantially greater than 0. If the Contractor fails to submit said monthly status report, it will be assumed that none of the Anticipated Weather Days were used for that month and they shall accumulate for possible future offset against Net Weather Days; however, if at the end of the Project, all Anticipated Weather Days have not been used, the Contract Completion Time will not be reduced.

4.1.8.3 Liquidated damages shall be assessed to the Contractor at $1,000 per day for each day that actual substantial completion exceeds the contract completion date, with consideration given to milestone dates set forth by Owner (in Summary of Work)

4.2 BID SECURITY

4.2.1.1 Each proposal shall be accompanied by Proposal Security in the amount of 5% of the largest possible total of the Proposal submitted. The Proposal Security shall be by cash, certified check or a Bid Bond. The Bid Bond shall be executed by the Proposer as principal. The Bid Bond form and security company are subject to approval by the Owner and the surety shall comply with requirements noted in Article 11 of the Supplementary General Conditions.

The Proposal security shall be returned to all except the three lowest Proposers within three days after opening of the proposals. The remaining Proposal securities shall be returned promptly after the Owner and the accepted Proposer have executed the Contract, or, if no award has been made within thirty days after the date of the opening of Proposals, upon demand of the Proposer any-time thereafter so long as he has not been notified of the acceptance of his Proposal.

The successful Proposer, upon his failure or refusal to execute and deliver the contract, insurance and bonds required within 10 days after he has received notice of the acceptance of his proposal, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his proposal.

4.3 SUBMISSION OF BIDS

4.3.1.1 All Proposers shall submit the following with their Proposal;
"Proposal Evaluation Waiver"
Refer to the checklist and forms below this section

4.3.1.2 The Proposal shall be manually signed by a person with legal authority to bind the firm to the Contract.

4.4 MODIFICATION OR WITHDRAWAL OF BID

4.4.2.1 If written confirmation of the modified or withdrawn bid is not received within two days from the closing time, no consideration shall be given to the modification or withdrawal.

THE FOLLOWING CHECKLIST AND FORMS ARE PROVIDED AND REQUIRED BY THE OWNER

PROPOSAL EVALUATION WAIVER

By submitting a Proposal, the Proposer indicated below agrees to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any Proposal. The Proposer further agrees that the Owner reserves the right to waive any requirements under the Proposal Documents or the Contract Documents, with regards to acceptance or rejection of any Proposals, and recommendation or award of the Contract.

NOTE: This Statement of Affirmation Must Be Notarized.

STATEMENT OF AFFIRMATION

"The undersigned affirms that he/she is duly authorized to execute this waiver by the person(s) or business entity making the proposal."

Firm's Name _____ Address: _____

_____

Proposer's
Name _____ Position/Title _____

Proposer's
Signature _____ Date _____

Subscribed and sworn to me on this _____ day of _____, _____.

_____
Notary Public

My Commission expires_____

NOTE: THIS FORM MUST BE EXECUTED AND SUBMITTED WITH PROPOSAL.

END OF FORM

Required Bid Forms

These forms are required documents for your bid to be considered.

AGREEMENT PACKET CHECKLIST:

Document Name	Party Responsible for Completing
1. ☐ State of Texas Bid Requirement Page	Contractor – **Complete & Return Required**
1a. ☐ Certification of Liability Insurance	Any services provided on AISD property must include a copy of their Certificate of Liability Insurance with Proposal Packet
2. ☐ Certification Regarding Debarment Form	Contractor – **Complete & Return Required**
3. ☐ Consultant/Contractors Certification Form	Contractor – **Complete & Return Required** If you will not be providing a service on site, mark "B" and complete and sign lower portion as acknowledgement
4. ☐ Form W-9	Contractor –**Complete & Return Required**
5. ☐ Hold Harmless Agreement	Contractor-applicable if providing a service * If not providing service indicate N/A & **return form**
6. ☐ Electronic Authorization Form	Contractor – **Complete & Return Required**
7. ☐ Release of Information	Contractor – **Complete & Return Required**
8. ☐ Federal Purchasing & Other Requirement Forms	Contractor –**Complete & Return Required**
9. ☐ ARMS/EDGAR Forms	Contractor – **Complete & Return Required**
10. ☐ USDA Lobbying Certification Form	Contractor – **Complete & Return Required**
11. ☐ Disclosure of Lobbying	Complete if Applicable
12. ☐ Conflict of Interest Questionnaire (Form CIQ)	If applicable, visit Alvin ISD Purchasing website for form.
13. ☐ HB 1295Form	Contractor – See additional instructions for clarity. **Complete & return with packet**

- State of Texas Bid Requirement Page -

(Must sign acknowledgement below and identify exceptions)

Vendors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. Bidder certifies that the company complies with Executive order 11246, entitled "Equal Employment Opportunity", as amended by Executive Order 11375 and as supplemented in Department of Labor Regulations.

VENDOR NON-COLLUSIVE BIDDING

By submission of this bid or proposal, the Bidder certifies that:

a) This proposal has been independently arrived at without collusion with any other Bidder or with any Competitor.

b) This bid or proposal has not been knowingly disclosed and will not be knowingly disclosed, prior to the opening of bids, or proposals for this project, to any other Bidder, Competitor or potential Competitor.

c) No attempt has been or will be made to induce my other person, partnership or corporation to submit or not to submit a bid or proposal.

d) The person signing this bid or proposal certifies that he has fully informed himself regarding the accuracy of the Statements contained in this certification, and under the penalties being applicable to the Bidder as well as to the person signing in its behalf.

CONFLICT OF INTEREST QUESTIONNAIRE (FORM CIQ)

Vendors are required to report business relationships at the time they begin contract negotiations or are solicited for bids or proposals. A vendor must disclose any business relationship with a district officer that might cause a conflict of interest. Vendors have 7 business days to file the Ethics commission's ***Conflict of Interest Questionnaire (form CIQ)*** or face the possibility of a Class C Misdemeanor.

- ☐ Vendor has no known Conflict of Interests with the District
- ☐ Vendor has a known Conflict of Interest and will be attaching a copy of the CIQ

FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History of Contractor states:

a) A person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony.

b) A school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract.

c) This section does not apply to a publicly-held corporation.

Please check off one box and sign the form in the appropriate space(s):

- ☐ My firm is a publicly-held corporation; therefore, this reporting requirement is not applicable.
- ☐ My firm is neither owned nor operated by anyone who has been convicted of a felony.
- ☐ My firm is owned and operated by the following individual(s) who has/have been convicted of a felony: Name of Felon(s):_____

Details of Conviction(s):_____

INSURANCE REQUIREMENTS – REQUIRED FOR WORK PERFORMED ON DISTRICT PROPERTY

The vendor shall carry Statutory Workmen's Compensation Insurance, Comprehensive General Liability Insurance covering premises operation and Contractor's Liability in the amount of $100,000/$300,000 for bodily injury and $100,000 each accident property damage and Automobile Liability covering all owned, non-owned, and hired vehicles in the amount of $100,000/$300,000 bodily injury and $100,000 each accident property damage. Certificates of Insurance shall be delivered to the Purchasing Department before work is commenced.

Upon award of bid, the vendor shall supply purchasing proof of insurance, in the manner prescribed by the Texas Worker's Compensation Commission, informing all persons providing services on the project that they are required to be covered, and station how a person may verify coverage and report lack of coverage.

The undersigned agrees to fully comply in strict accordance with the above requirements, terms and specifications

_____ _____ _____

Acknowledgment by Signature *Printed Name* *Date*

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, *Federal Register* (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

1.) By signing and submitting this form, the prospective lower tier participant *(vendor submitting proposal)* is providing the certification set out below in accordance with these instructions. 2.) The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant *(vendor submitting proposal)* knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment. 3.) The prospective lower tier participant *(vendor submitting proposal)* shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant *(vendor submitting proposal)* learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances. 4.) The terms "covered transaction", "debarred", "suspended", "ineligible"," lower tier covered transaction", "participant", "person", "primary covered transaction", "principal", "proposal", and "voluntarily excluded" as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. https://www.federalregister.gov/articles/2010/07/19/2010-17429/nonprocurement-debarment-and-suspension
5.)The prospective lower tier participant *(vendor submitting proposal)* agrees by submitting this form that, should the proposed covered transaction *(contract)* be entered into, it shall not knowingly enter into any lower tier covered transaction *(contract)* with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction *(contract)*, unless authorized by the department or agency with which this transaction originated. 6.) The prospective lower tier participant *(vendor submitting proposal)* further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions *(contract)* and in all solicitations for lower tier covered transactions *(contract)*. 7.) A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction *(contract)* that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Non-procurement List. 8.) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings. 9.) Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction *(contract)* with a person who is suspended, debarred, ineligible, or voluntarily excluded from participating in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ABOVE)

(1) The prospective lower tier participant (vendor submitting proposal) certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency. (2) Where the prospective lower tier participant (vendor submitting proposal) is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

The undersigned agrees to fully comply in strict accordance with the above requirements, terms and specifications

Name and Title of Authorized Representative	
Authorized Signature	Date (mm/dd/yyyy)

ALVIN INDEPENDENT SCHOOL DISTRICT

Consultant/Contractors Certification Form

Introduction:

Texas Education Code Chapter 22 and Senate Bill 9 require service contractors to obtain criminal history record information regarding covered employees and to certify to the District that they have done so. Contractors must comply with Texas Education Code, Section 22.0834, regarding the Criminal History Record Information Review of Certain Contract Employees. Before work on this contract begins, Contractors shall have all employees that will be performing services at the district, fingerprinted through the criminal history clearinghouse as provided by Section 411.0845, Government Code relating to an employee or applicant who has or will have duties related to the contracted services; and the employee or applicant has or will have direct contact with students. The DISTRICT WILL obtain criminal history record information before employing or securing the services of the CONTRACTOR or applicant that has or will have direct contact with students. The contractor further agrees that he shall assume all expenses associated with the criminal background check and shall immediately remove any employee or agent who was convicted of a felony, or misdemeanor involving moral turpitude, as defined by the Texas law, from District property or the location where students are present.

Please visit a Guide for School Contractors Section for additional information regarding Senate Bill 9.

Definitions:

Covered employees: All employees of a contractor who have or will have work duties that have been or will be performed on District property DURING THE TIME STUDENTS ARE SCHEDULED TO BE ON THE PROPERTY related to the service to be performed at the District and WILL HAVE ACCESS TO THE FACILITIES IN WHICH STUDENTS ARE IN OCCUPANCY. The District will be the final arbiter of what constitutes direct contact with students.

On behalf of _____ (Individual Consultant or Contractor's Name of Company), **I certify that the [check one]:**

◯ A.) Individual Contractor or Contractor's employees are covered employees and have been processed through the FACT Clearinghouse as **HAVING CONTACT with students.**

AND ***MANDATORY DATA FOR INQUIRY:*** *Date of Birth_____

*Driver's License # _____ or * State ID _____

*TxDPS SID # _____ (FACT Clearinghouse State assigned ID number)

-Or-

◯ B.) Individual Consultant or Contractor's employees are not covered employees as defined above and **DO NOT HAVE CONTACT with students.**

---

(1) By providing a release along with the names, Texas drivers license number and the date of birth of each any every employee, that will perform services on district property, the Contractor will make available for the District's inspection, the criminal history record information of any covered employee. If the District objects to the assignment of a covered employee on the basis of the covered employee's criminal history record information, Contractor agrees to discontinue using that covered employee to provide services at the District.

Noncompliance by Contractor with this certification May be grounds for contract termination, and May be a violation of State Law as described in Senate Bill 9 and/or TEC 22.

***By* submission of this form, I am indicating that I am complying with Senate Bill 9 and Texas Education Code Section 22.0834 Criminal History Record Information Review of Certain Contract Employees.**

Date: _____

Company Name (If Contractor / Company): _____

Address: _____

City: _____ **State:** _____ **Zip:** _____

Contact Person: _____

Phone: _____ **Fax:** _____

E-mail Address: _____

Authorized Signature: _____

Return Completed and Signed Contractor Certification Form with Backup and Contracted Service Contract to:

Alvin ISD Purchasing Department
Attn: Jennifer Ortiz
2200 Stapp Maxwell
Alvin, Texas 77511
Phone 281-245-2430
jortiz@alvinisd.net

Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

▶ **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See **Specific Instructions** on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ▶

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any)

Exemption from FATCA reporting code (if any)

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN*, later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

___ – ___ – ____

or

Employer identification number

___ – _____

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here | **Signature of U.S. person** ▶ | **Date** ▶

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9*.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

ALVIN ISD

(TO BE COMPLETED AND RETURNED BY VENDOR)

Hold Harmless Agreement

The Proposer shall defend, indemnify, and hold harmless, Alvin ISD and all its trustees, officers, agents, and employees, from and against all suits, actions, or claims of any character brought forth or on account of any injuries or damages (including death) received or sustained by any person or property on account of, arising out of, or in connection with, any negligent act or omission of contractor or any agent, employee, subcontractor or supplier of contractor in the execution or performance under this contract as designated as CONTRACTED SERVICES.

The proposer shall also defend, indemnify and hold harmless, Alvin ISD and all of its trustees, officers, agents and employees, from and against claims by any subcontractor, supplier, laborer, material-man or mechanic for payment for work materials provided on behalf of the Contractor in the performance of the Contract and all such claimants shall look solely to Contractor and not Alvin ISD for satisfaction of such claims.

This Hold Harmless Agreement shall be binding upon the undersigned, and its successors, legal representatives, heirs and assigns.

DATED THIS _____ DAY OF _____, 20___.

Contractor:

_____
Company Name

_____
Name of Representative (Print)

_____
Signature of Representative

ELECTRONIC AUTHORIZATION FORM FOR APPROVED AWARDED VENDORS

Attach voided check or provide a bank letter
With ACH Routing number & Account information*

☐ ***New-Add Request*** ☐ ***Change-Existing Account Information***

Alvin ISD is now going Green with their Munis Finance System. By submission of this form, we can now email copies of purchase orders to company sales representatives. We can also send electronic fund transfer directly to a checking or savings account as well as send receipt of your EFT. You have the option to do BOTH or start out with just PO emails to your company. We will also use this form for any changes to your vendor profiles. (PRINT THE FOLLOWING INFORMATION ALL SPACES NEED TO BE COMPLETED)

Company Name : _____

COMPLETE COMPANY INFORMATION IF YOU ARE REQUESTING PURCHASE ORDER SENT ELECTRONICALLY.

COMPANY ADDRESS	
CITY, STATE, ZIP CODE	
PRINT NAME AND TITLE	
CONTACT PHONE NUMBER	
EMAIL (PRIMARY)	
EMAIL (SECONDARY)	

*I authorize Alvin ISD to deposit my payment from the Alvin ISD to my financial institution electronically. I understand that the Alvin ISD will reverse any payments made to my account in error. I further understand that the Alvin ISD will comply at all times with the National Automated Clearing House Association's rules. (For further information on these rules, please contact your financial institution.) I also understand cancellation of electronic payment must be submitted in writing to Alvin ISD.

COMPLETE BANKING INFORMATION IF YOU ARE REQUESTING EFT PAYMENT (ELECTRONIC FUNDS TRANSFER.)

COMPANY NAME	
FEDERAL ID# OR SSN#	
BANK NAME	
BANK ROUTING NUMBER	
CHECKING ACCT.#	
SAVING ACCT. #	

I RECOGNIZE THAT IF I FAIL TO PROVIDE COMPLETE AND ACCURATE INFORMATION ON THIS AUTHORIZATION FORM, THE PROCESSING OF THE FORM MAY BE DELAYED OR THAT MY PO'S OR PAYMENTS MAY BE ERRONEOUSLY TRANSFERRED ELECTRONICALLY.

_____ _____

Authorized Signature Date

_____ _____

Printed Name Title

ALVIN INDEPENDENT SCHOOL DISTRICT

RELEASE OF INFORMATION

At various times throughout the year, we will receive formal requests to provide your information to third parties. The requested files include records we received from you or from your company which may include, all purchase orders, quotes, check info, vendor info, contact info, line item descriptions quantities and pricing. Generally, the Public Information Act (the "Act") requires the release of requested information, but there are exceptions.

◯ I authorize release of my information to third party requestors.

◯ I do not authorize release of my information to third party requestors.

***Please note – if you marked that you "do not wish" to have information released when an open record request has the information is requested, you will receive a notice from Alvin ISD, so that you may send your rebuttal to the Office of the Attorney General.

This notice will be placed in our record with your proposal and will remain in effect thru the term of your proposal contract.

Texas Government Code **Sec. 552.372 Bids and Contracts states:**

(a) A contract described by Section 552.371 (Certain Entities Required to Provide Contracting Information to Governmental Body in Connection With Request) must require a contracting entity to:

(1) preserve all contracting information related to the contract as provided by the records retention requirements
applicable to the governmental body for the duration of the contract;
(2) promptly provide to the governmental body any contracting information related to the contract that is in the
custody or possession of the entity on request of the governmental body; and
(3) on completion of the contract, either:

(A) provide at no cost to the governmental body all contracting information related to the contract that is in the custody or possession of the entity; or

(B) preserve the contracting information related to the contract as provided by the records retention requirements applicable to the governmental body.

(b)Unless Section 552.374 (Termination of Contract for Noncompliance)(c) applies, a bid for a contract described by Section 552.371 (Certain Entities Required to Provide Contracting Information to Governmental Body in Connection With Request) and the contract must include the following statement: "The requirements of Subchapter J, Chapter 552 (Public Information), Government Code, may apply to this (include "bid" or "contract" as applicable) and the contractor or vendor agrees that the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter."

(c)A governmental body may not accept a bid for a contract described by Section 552.371 (Certain Entities Required to Provide Contracting Information to Governmental Body in Connection With Request) or award the contract to an entity that the governmental body has determined has knowingly or intentionally failed to comply with this subchapter in a previous bid or contract described by that section unless the governmental body determines and documents that the entity has taken adequate steps to ensure future compliance with the requirements of this subchapter.

The requirement of Subchapter J, Chapter 552, Government Code, may apply to this and the contractor or vendor agrees that the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter.

REQUIRED FORM OF UNDERSTANDING – RETURN THIS COMPLETE PAGE WITH PROPOSAL - Does vendor certify? Yes Initials of Authorized Representative
Company Name _____ **Date**

FEDERAL COMPLIANCE
GUIDELINES FOR THE USE OF FEDERAL FUNDS

Alvin ISD has elected to solicit pricing from Qualifying Vendors, Awarded Proposals Vendors and/or Cooperative Vendors as set forth under the requirements of the Code of Federal Regulations (CFR) Title 2 Grants and Agreements, Part 200 Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards. (2 CFR§200).

Following these federal requirements will allow for federal funds, entrusted to Alvin ISD, to be used to make purchases through the anticipated contract(s). The CFR is the codification of the general and permanent rules published in the Federal Register by the departments and agencies of the Federal Government produced by the Office of the Federal Register (OFR) and the Government Publishing Office. The CFR may change during the term of the contract and the supplier may be required to make adjustments as necessary.

It is necessary for the supplier to certify and agree that they, as a company, understand and comply with all applicable areas identified below and included with this attachment. Some of the areas may not be applicable to this solicitation and it is the supplier's sole responsibility to identify which areas are appropriate for the solicitation. Failure to affirm and agree to these requirements may, at Alvin ISD's discretion, disqualify the associated response to this solicitation or limit the use of the awarded contract based on the funding source.

Alvin ISD reserves the right, at any time within the contract term, to require an awarded supplier to reaffirm, sign and resubmit proper documentation stating their company is not debarred, or if any other circumstances change related to the original response.

The following terms are applicable to all solicitations:

1. **General.** Included for all solicitations regardless of type of specialty.

1.1 ***Debarment and Suspension (executive Orders 12549 and 12689).*** A contract award (see 2 CFR 180.220) must not be made to parties listed on the government wide Excluded Parties List System in the System of Award Management (SAM), in accordance with the OBM guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR Part 1986 Comp., p. 189) and 12689 (3 CFR Part 1989 Comp., p. 235), "Debarment and Suspension" The Excluded Parties Listed System in SAM (sam.gov) contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. Prior to award, Alvin ISD will verify that the supplier is not currently listed as debarred by the Federal government. If the supplier is found to be on the Federal debarment list, Alvin ISD, at its sole option, may elect to not award to the supplier. If awarded, and during the contract term, the supplier becomes debarred, the supplier must notify Alvin ISD within five (5) Alvin ISD business days of the debarment. Alvin ISD, at its sole judgement, may elect to cancel the associated contract or limit the contract to non-federal funds. Such judgement will be done in writing within twenty (20) Alvin ISD business days. During this assessment period, no contract orders can be placed by Alvin ISD using federal funds.

1.2 ***Conflict of Interest. 2 CFR 200.318(c)(1)*** states that Alvin ISD must maintain written standards of conduct covering conflicts of interest and governing the actions of its employees engaged in the selection, award and administration of contract. No employee, officer, or agent may participate in the selection, award, and administration of a contract supported by a Federal award if he or she has a real or apparent conflict of interest. Such a conflict of interest would arise when the employee, officer, or agent, any member of his or her immediate family, his or her partner, or an organization which employs or is about to employ any of the parties indicated herein, has a financial or other interest in or a tangible personal benefit from the contract awarded to a specific supplier. The

FEDERAL COMPLIANCE - REQUIRED FORM OF UNDERSTANDING – RETURN THIS COMPLETE PAGE WITH PROPOSAL - Does vendor certify? Yes _____ Initials of Authorized Representative of Vendor

officers, employees, and agents of Alvin ISD may neither solicit nor accept gratuities, favors, or anything of monetary value from suppliers or parties to subcontracts. However, Alvin ISD may set standards for situations in which the financial interest is not substantial or the gift is an unsolicited item of nominal value. The standards of conduct must provide for disciplinary actions to be applied for violations of such standards by officers, employees, or agents of Alvin ISD. It is the responsibility for the supplier to identify and make Alvin ISD aware of any potential conflicts of interest that exist between their company and Alvin ISD. Failure to do so will cause the associated supplier response to be disqualified from further consideration, or if already awarded, the associated contract will be cancelled based on cause.

1.3 ***HUB Certification.*** Pursuant of 2 CFR 200.321. Bidding companies that have been certified by the State of Texas as Historically Underutilized Business (HUB) entities are encouraged to **attach a copy of the HUB Certification** when responding to this proposal invitation. This information will be included in the vendor profiles and may be used for consideration of purchase(s).

1.4 ***Termination for Cause.*** All federal contracts, in excess of $10,000, must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be affected and the basis for settlement. As per Alvin ISD does not have a threshold, all contracts for any amount may be terminated for cause.

2. ***Small Purchases (2 CFR 200.320).*** Small purchase procedures are those relatively simple and informal procurement methods for securing services, supplies, or other property that do not cost more than the *Simplified Acquisition Threshold (SAT).*

2.1 If small purchase procedures are used, price and rate quotations must be obtained from an adequate number of qualified sources. Specifically for multiple award catalog-based or non-identifiable pricing based on a percentage off catalog, Alvin ISD may be required to submit a request for quotation from the contracted vendors for the purpose of meeting the competitive bidding requirements of this section.

3. ***Large Purchases.*** For individual purchases that exceed the *Simplified Acquisition Threshold.*

3.1 *Simplified Acquisition Threshold Contracts* for more than the Simplified Acquisition Threshold (SA) currently set at $250,000 which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulation Council (Councils) as authorized by 41 U.S.C. 1980, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate. In any case, contracts in excess of the state's or state agency threshold must address the foregoing. Any purchase that meets or exceeds the SAT threshold will require additional cost/price analysis by Alvin ISD. The supplier may be required to provide additional documentation to support this requirement based on the federal requirements at the time of the purchase.

3.2 *Cost Analysis/Negotiation of Profit (2 CFR 200.323).* For contracts over the SAT, Alvin ISD must negotiate profit as a separate element of the price for each contract in which there is no price competition, including solicitations that received only one viable response. In all cases, a cost analysis is to be performed by Alvin ISD. To establish a fair and reasonable profit, consideration must be given to the complexity of the work to be performed, the risk borne by the contractor, the contractor's investment, the amount of subcontracting, the quality of its record of past performance, and industry profit rates in the surrounding geographical area for similar work.

3.3 *Supplier Violation or Breach of Contract Terms.* For contract awards valued at or greater than the SAT, Alvin ISD must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate. The remedies under the contract are in addition to any other remedies that may be

FEDERAL COMPLIANCE - REQUIRED FORM OF UNDERSTANDING – RETURN THIS COMPLETE PAGE WITH PROPOSAL - Does vendor certify? Yes _____ Initials of Authorized Representative of Vendor

4. CERTIFICATIONS REQUIRED UNDER FEDERAL CONTRACT PROVISIONS (2 CFR 200.326)

4.1 The following pages contain the required Contract Provisions that must be certified by the vendor of use with Federal Contracts. By initialing the following statements, you Certify your Company will hold true to these provisions for the duration of the proposal.

4.2 It is the responsibility for the supplier to identify and make Alvin ISD aware of any potential changes that exist between their company and Alvin ISD. Failure to do so will cause the associated supplier response to be disqualified from further consideration, or if already awarded, the associated contract will be cancelled based on the cause.

FEDERAL COMPLIANCE - REQUIRED FORM OF UNDERSTANDING – RETURN THIS COMPLETE PAGE WITH PROPOSAL - Does vendor certify? Yes _____ Initials of Authorized Representative of Vendor

EDGAR CERTIFICATIONS

Addendum FOR CONTRACT FUNDED BY a U.S. FEDERAL GRANT

The following certifications and provisions are required and apply when Alvin Independent School District ("Alvin ISD") expends federal funds for any contract resulting from this procurement process. **Accordingly, the parties agree that the following terms and conditions apply to the Contract between the District and _____ ("Vendor") in all situations where Vendor has been paid or will be paid with federal funds:**

CERTIFICATION REGARDING EMPLOYMENT ASSISTANCE PROHIBITED

Vendor certifies and agrees that it shall not assist an employee, contractor, or agent of Alvin ISD or any other school district, in obtaining a new job if the Vendor knows, or has probable cause to believe that the individual engaged in sexual misconduct regarding a minor or student in violation of the law. Routine transmission of an administrative or personnel file does not violate this prohibition. See Alvin ISD Policy CJ (Legal) and (Local).

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

REQUIRED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS APPENDIX II TO 2 CFR PART 200

(A) Contracts for more than the simplified acquisition threshold currently set at $250,000, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

Pursuant to Federal Rule (A) above, when ALVIN ISD expends federal funds, ALVIN ISD reserves all rights and privileges under the applicable laws and regulations with respect to this procurement in the event of breach of contract by either party.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

(B) Termination for cause and for convenience by the grantee or sub grantee including the manner by which it will be affected and the basis for settlement. (All contracts in excess of $10,000)

Pursuant to Federal Rule (B) above, when ALVIN ISD expends federal funds, ALVIN ISD reserves the right to immediately terminate any agreement in excess of $10,000 resulting from this procurement process in the event of a breach or default of the agreement by Vendor in the event Vendor fails to: (1) meet schedules, deadlines, and/or delivery dates within the time specified in the procurement solicitation, contract, and/or a purchase order; (2) make any payments owed; or (3) otherwise perform in accordance with the contract and/or the procurement solicitation. ALVIN ISD also reserves the right to terminate the contract immediately, with written notice to vendor, for convenience, if ALVIN ISD believes, in its sole discretion that it is in the best interest of ALVIN ISD to do so. Vendor will be compensated for work performed and accepted and goods accepted by ALVIN ISD as of the termination date if the contract is terminated for convenience of ALVIN ISD. Any award under this procurement process is not exclusive and ALVIN ISD reserves the right to purchase goods and services from other vendors when it is in ALVIN ISD's best interest.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

(C) Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

Pursuant to Federal Rule (C) above, when ALVIN ISD expends federal funds on any federally assisted construction contract, the equal opportunity clause is incorporated by reference herein.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

(D) Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or sub recipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

Pursuant to Federal Rule (D) above, when ALVIN ISD expends federal funds during the term of an award for all contracts and sub grants for construction or repair, Vendor will be in compliance with all applicable Davis-Bacon Act provisions.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(E) Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

Pursuant to Federal Rule (E) above, when ALVIN ISD expends federal funds, Vendor certifies that Vendor will be in compliance with all applicable provisions of the Contract Work Hours and Safety Standards Act during the term of an award for all contracts by ALVIN ISD resulting from this procurement process.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(F) Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of "funding agreement" under 37 CFR §401.2 (a) and the recipient or sub recipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or sub recipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

Pursuant to Federal Rule (F) above, when federal funds are expended by ALVIN ISD, Vendor certifies that during the term of an award for all contracts by ALVIN ISD resulting from this procurement process, Vendor agrees to comply with all applicable requirements as referenced in Federal Rule (F) above.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(G) Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended—Contracts and sub grants of amounts in excess of $150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant

to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251- 1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

Pursuant to Federal Rule (G) above, when federal funds are expended by ALVIN ISD, Vendor certifies that during the term of an award for all contracts by ALVIN ISD resulting from this procurement process, Vendor agrees to comply with all applicable requirements as referenced in Federal Rule (G) above.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(H) Debarment and Suspension (Executive Orders 12549 and 12689)—A contract award (see 2 CFR 180.220) must not be made to parties listed on the government wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

Pursuant to Federal Rule (H) above, when federal funds are expended by ALVIN ISD, Vendor certifies that during the term of an award for all contracts by ALVIN ISD resulting from this procurement process, Vendor certifies that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation by any federal department or agency.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(I) Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)—Contractors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

Pursuant to Federal Rule (I) above, when federal funds are expended by ALVIN ISD, Vendor certifies that during the term and after the awarded term of an award for all contracts by ALVIN ISD resulting from this procurement process, the vendor certifies that it is in compliance with all applicable provisions of the Byrd Anti-Lobbying Amendment (31 U.S.C. 1352). The undersigned further certifies that:

a) No Federal appropriated funds have been paid or will be paid for on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of congress, or an employee of a Member of Congress in connection with the awarding of a Federal contract, the making of a Federal grant, the making of a Federal loan, the entering into a cooperative agreement, and the extension, continuation, renewal, amendment, or modification of a Federal contract, grant, loan, or cooperative agreement.

b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying", in accordance with its instructions.

c) The undersigned shall require that the language of this certification be included in the award documents for all covered sub-awards at all tiers (including subcontracts, sub grants, and contracts under grants, loans and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certificate is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for such failure.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(J) Procurement of Recovered Materials – When federal funds are expended by Alvin ISD and their contractors, they must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include: (1) procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 4 CFR part 247 that contains the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level competition, where the purchase price of the items exceeds $10,000, or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; (2) procuring solid waste management services in a manner that maximizes energy and resource recovery; and (3) establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Pursuant to Federal Rule (J) above, when federal funds are expended by Alvin ISD, as required by the Resource Conservation and Recovery Act of 1975 (42 U.S.C. §6962 (c)(3)(A)(i)), the vendor certifies, by signing this document, that the percentage of recovered materials content for the EPA-designated items to be delivered or used in the performance of the contract will be at least the amount required by the applicable contract specifications or other contractual requirements.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

(K) Required Affirmative Steps for Small, Minority, and Women-Owned Firms for Contracts Paid for with Federal Funds –

Pursuant to Federal Rule (K) 2 CFR §200.321 – When federal funds are expended by Alvin ISD, Vendor is required to take all affirmative steps set forth in 2 CFR§200.321 to solicit and reach out to small, minority and women owned firms for any subcontracting opportunities on the project, including: 1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists; 2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources; 3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises; 4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises; 5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

RECORD RETENTION REQUIREMENTS FOR CONTRACTS INVOLVING FEDERAL FUNDS

When federal funds are expended by ALVIN ISD for any contract resulting from this procurement process, Vendor certifies that it will comply with the record retention requirements detailed in 2 CFR § 200.333. Vendor further certifies that it will retain all records as required by 2 CFR § 200.333 for a period of three years after grantees or sub grantees submit final expenditure reports or quarterly or annual financial reports, as applicable, and all other pending matters are closed.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

CERTIFICATION OF COMPLIANCE WITH EPA REGULATIONS APPLICABLE TO GRANTS, SUBGRANTS, COOPERATIVE AGREEMENTS, AND CONTRACTS IN EXCESS OF $100,000 OF FEDERAL FUNDS

When federal funds are expended by Alvin ISD for any contract resulting from this procurement process in excess of $100,000, the vendor certifies that the vendor will be in compliance with all applicable standards, orders, regulations, and/or requirements issued pursuant to the Clean Air Act of 1970, as amended (42 U.S.C. 1857 (h)), Section 508 of the Clean Water Act as amended (33 U.S.C. 1368), Executive Order 117389 and Environmental Protection Agency Regulation, 40CFR Part 15.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION OF COMPLIANCE WITH THE ENERGY POLICY AND CONSERVATION ACT

When federal funds are expended by Alvin ISD for any contract resulting from this procurement process, the vendor certifies that the vendor will be in compliance with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub. L. 94-163, 89 Stat. 871).

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION OF COMPLIANCE WITH BUY AMERICAN PROVISIONS

Vendor certifies that vendor is in compliance with all applicable provisions of the Buy American Act. Purchases made in accordance with the Buy American Act must follow the applicable procurement rules calling for free and open competition.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION OF EQUAL EMPLOYMENT STATEMENT

It is the policy of ALVIN ISD not to discriminate on the basis of race, color, national origin, gender, limited English proficiency or handicapping conditions in its programs. Vendor agrees not to discriminate against any employee or applicant for employment to be employed in the performance of this Contract, with respect to hire, tenure, terms, conditions and privileges of employment, or a matter directly or indirectly related to employment, because of age (except where based on a bona fide occupational qualification), sex (except where based on a bona fide occupational qualification) or race, color, religion, national origin, or ancestry. Vendor further agrees that every subcontract entered into for the performance of this Contract shall contain a provision requiring non-discrimination in employment herein specified, binding upon each subcontractor. Breach of this covenant may be regarded as a material breach of the Contract.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION OF NON-COLLUSION STATEMENT

Vendor certifies under penalty of perjury that its response to this procurement solicitation is in all respects bona fide, fair and made without collusion or fraud with any person, joint venture, partnership, corporation or other business or legal entity.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION OF COMPLIANCE WITH TEXAS FAMILY PROVISION

~~As per Section 14.52 of the Texas Family Code, added by S.B. 84, Acts, 73rd Legislature, R.S. (1993), all bidder must~~ complete and submit with the bid the following affidavit:

I, the undersigned vendor do hereby acknowledge that NO sole proprietor, partner, majority shareholder of a corporation, or an owner of 10% or more of another business entity is 30 days or more delinquent in paying child support under a court order or a written repayment agreement. I understand that under this provision, a sole proprietorship, partnership, corporation or other entity is 30 days or more delinquent in paying child support under a court order or a written repayment agreement is NOT eligible to bid or receive a state contract.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION OF HEALTH AND SAFETY CERTIFICATIONS LICENSING OR REGULATIONS

Vendor certifies under penalty of perjury that with its response to this procurement, that all required applicable local, state and federal health and safety certifications, licensing or regulations, which include, but are not limited, to facility use, food establishment and authorized providers are in good standing and current.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

CERTIFICATION REGARDING TERRORIST ORGANIZATIONS & BOYCOTTING OF ISRAEL GOVT. CODE 808 (HB 89) & GOVT. CODE 2252 (SB252)

Vendor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State.

If (a) Contractor is not a sole proprietorship; (b) Contractor has ten (10) or more full-time employees; and (c) this Agreement has a value of $100,000 or more, the following certification shall apply; otherwise, this certification is not required. Pursuant to Chapter 2270 of the Texas Government Code, the Contractor hereby certifies and verifies that neither the Contractor, nor any affiliate, subsidiary, or parent company of the Contractor, if any (the "Contractor Companies"), boycotts Israel, and the Contractor agrees that the Contractor and Contractor Companies will not

boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

CERTIFICATION OF ACCESS TO RECORDS – 2 C.F.R. § 200.336

Vendor agrees that the District's Inspector General or any of their duly authorized representatives shall have access to any books, documents, papers and records of Vendor that are directly pertinent to Vendor's discharge of its obligations under the Contract for the purpose of making audits, examinations, excerpts, and transcriptions. The right also includes timely and reasonable access to Vendor's personnel for the purpose of interview and discussion relating to such documents.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

---

CERTIFICATION OF APPLICABILITY TO SUBCONTRACTORS

Vendor agrees that all contracts it awards pursuant to the Contract shall be bound by the foregoing terms and conditions.

Does vendor certify? YES _____ Initials of Authorized Representative of Vendor

VENDOR AGREES TO COMPLY WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, RULES, REGULATIONS, AND ORDINANCES. IT IS FURTHER ACKNOWLEDGED THAT VENDOR CERTIFIES COMPLIANCE WITH ALL PROVISIONS, LAWS, ACTS, REGULATIONS, ETC. AS SPECIFICALLY NOTED ABOVE.

Company Name:_____

Address, City, State, and Zip Code: _____

Phone Number: _____ Fax Number: _____

Printed Name and Title of Authorized Representative: _____

Email Address: _____

Signature of Authorized Representative: _____

Date: _____

FORM REQUIRED

U.S. Department of Agriculture Lobbying
Certification Regarding Lobbying Form

Applicable to Grants, Sub-grants, Cooperative Agreements, and Contracts Exceeding $100,000.00 in Federal Funds Submission of this certification is a prerequisite for making or entering into this transaction and is imposed by section 1352, Title 31, U.S. Code. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000.00 and not more than $100,000.00 for each such failure.

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of congress, or an employee of a Member of Congress in connection with the award of a Federal contract, the making of a Federal grant, the making of a Federal loan, the entering into a cooperative agreement, and the extension continuation, renewal, amendment, or modification of a Federal contract, grant, loan or cooperative agreement.

(2) **If any funds other than Federal appropriated funds have been paid or will be paid to any person for influence or attempting to influence an officer or employee of any agency, a Member of Congress, an officer of employee of congress, or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete and submit Standard Form –LLL, "disclosure Form to Report Lobbying," in accordance with its instructions.**
(Form not included in this packet but can be accessed through Purchasing Federal Compliance Website and must be completed and submitted IF APPLICABLE).

(1) The undersigned shall require that the language of this certification be included in the award documents for all covered sub-awards exceeding $100,000.00 in Federal funds at all appropriate tiers and that all sub-recipients shall certify and disclose accordingly.

Name of Organization

Address of Organization

Name / Title of Submitting Official

Signature

Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

1. Type of Federal Action: a. contract ____ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	2. Status of Federal Action: a. bid/offer/application _____ b. initial award c. post-award	3. Report Type: a. initial filing _____ b. material change For material change only: Year _____ quarter _____ Date of last report_____

4. Name and Address of Reporting Entity: ____ Prime _____ Subawardee Tier_____, if Known: Congressional District, *if known*:	5. If Reporting Entity in No. 4 is Subawardee, Enter Name and Address of Prime: Congressional District, *if known*:
6. Federal Department/Agency:	7. Federal Program Name/Description: CFDA Number, *if applicable*: _____
8. Federal Action Number, *if known*:	9. Award Amount, *if known*: $
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI)*:	b. Individuals Performing Services *(including address if different from No. 10a)* *(last name, first name, MI)*:
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	Signature: _____ Print Name: _____ Title: _____ Telephone No.: _____ Date: _____
Federal Use Only	Authorized for Local Reproduction Standard Form - LLL (Rev. 7-97)

House Bill 1295

As of January 1, 2016, a new state policy was implemented that affects all proposals which are awarded by our Board of Trustees. HB1295 basically states the following…

House Bill 1295 amended the Texas Government Code by adding Section 2252.908, the Disclosure of Interested Parties. Under this Section 2252.908, (Alvin ISD) is prohibited from entering into a contract resulting from an RFP with a business entity unless the business entity submits a Disclosure of Interested Parties (Form 1295) to the District at the time business entity submits the signed contract. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Texas Ethics Commission.

Changes to the law requiring certain businesses to file a Form 1295 are in effect for contracts entered into or amended on or after January 1, 2018. The changes exempt certain businesses from filing a Form 1295 for certain types of contracts and replace the need for a completed Form 1295 to be notarized. Instead, the person filing a 1295 needs to complete an "unsworn declaration."

Detailed Instructions for Compliance with HB1295

VENDOR'S Responsibility for Compliance:

1) Go to the Ethics Commission Website using the following link to register and complete FORM 1295 - Certificate of Interest Parties Electronic Filing Application:
https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm
Proposers must complete the filing application Form 1295 ***electronically*** with the Texas Ethics Commission using their online filing application.

As a "business entity," all vendors must electronically complete, print, sign and submit Form 1295 with their proposals or contracts even if there are no conflicting interested parties within the district unless:

Form 1295 is not required for the following contracts if entered into or amended on or after January 1, 2018:

- (1) a sponsored research contract of an institution of higher education;
- (2) an interagency contract of a state agency or an institution of higher education;
- (3) a contract related to health and human services if:

  (a) the value of the contract cannot be determined at the time the contract is executed; and

  (b) any qualified vendor is eligible for the contract;

- (4) a contract with a publicly traded business entity, including a wholly owned subsidiary of the business entity;*
- (5) a contract with an electric utility, as that term is defined by Section 31.002, Utilities Code;* or
- (6) a contract with a gas utility, as that term is defined by Section 121.001, Utilities Code.*

2) Proposers must print a copy of the completed form, which will include a certification of filing containing a unique certification number
3) Fill out the bottom (number 6 on the form) titled "Unsworn Declaration" and sign at the bottom. This Form 1295 must be signed by an authorized agent of the business entity.
4) Send a copy of the form via email to Jennifer Ortiz, jortiz@alvinisd.net or by fax number to our Purchasing Department is 281-585-4567.
   ADDITIONAL NOTATION: The Form 1295 must be completed for every contract entered into with Alvin ISD that will be awarded by the board.

Alvin ISD Responsibility for Compliance:

1) Once received, Alvin ISD must acknowledge the receipt of the filed Form 1295 by notifying the Texas Ethics Commission of the receipt of the filed Form 1295 **no later than the 30th day after the date the contract is approved at our board meeting.**

2) After Alvin ISD acknowledges the Form 1295, the Texas Ethics Commission will post the completed Form 1295 to its website within seven business days.

3) The completed Form 1295 with the certification of filing will be filed with your completed proposal or contract that was provided to the district for board award.

4) Upon award of the proposal, and review of all required signed documents, Purchasing will process vendor numbers to staff for issuance of purchase order.

ADDITIONAL NOTATION: Failure to comply with HB 1295 will result in your vendor packet being suspended from processing and no business can be conducted with your company until compliance has been provided by your company to Alvin ISD.

Additional Information to Help Clarify HB1295:

- Should you have questions, concerns or require additional information, please contact the Texas Ethics Commission at 512-463-5800; their office hours are from 8:00 am to 5:00 pm Monday through Friday.

- For questions submitting Form 1295 to Alvin ISD:
  - Contact Jennifer Ortiz at 281-245-2430, or by email at jortiz@alvinisd.net .
  - You may fax your signed copy to 281-585-4567

** Alvin ISD is not required at this time to keep the original documentation; therefore, it can be scanned electronically and received by email or by fax to the Purchasing Department or submitted with proposal documentation.

** HB1295 affects all Government Entities (including public school districts) entering into contracts whereby their Board of Trustees awards the contracts. Therefore, should you enter into any other contracts with other school districts, universities, colleges, or government municipalities be prepared to complete this form for their contracts as well.

Definitions Utilized for Completing Form 1295 include:

"Interested Party" means a person:
- Who has a **controlling interest** in a business entity with whom AISD contracts; or
- Who actively participates in **facilitating the contract or negotiating the terms of the contract** with Alvin ISD, including a broker, intermediary, adviser, or attorney for the business entity

"Business Entity" means an entity:
- Who is recognized by law through which business is conducted, including a sole proprietorship, partnership or corporation.
  - This includes NonProfit and For-Profit Organizations as a Business Entity

"Intermediary" for purposes of this rule, means a person:
- Who actively participates in the facilitation of the contract or negotiating the contract, including a broker, adviser, attorney, or representative of or agent for the business entity who:
  - Receives compensation from the business entity for the person's participation
  - Communicates directly with Alvin ISD on behalf of the business entity regarding the contract
  - AND is not an employee of the business entity

"Controlling Interest" means a person:
- Whereby has ownership interest or participating interest in the business entity by virtue of units, percentage, shares, stock, or otherwise that exceeds 10 percent
- Is a member on the board of directors or other governing body of a business entity of which the board or other governing body is composed of not more than 10 members
- Who serves as an officer of a business entity that has four or fewer officers or service as one of the four officers most highly compensated by a business entity that has more than four officers

SECTION 00 23 13 - RANKING CRITERIA FOR COMPETITIVE SEALED PROPOSALS

In order for the Owner and Architect to properly evaluate each proposer's qualifications, each proposer shall submit (1) printed/bound hardcopy and (2) electronic copies of the Qualifications Package, with all required attachments and information, with their bid submission.

Qualifications Packages will include AIA A305, "Contractors Qualification Statement," and its required attachments and information, and the following:

1. A copy of each Certificate of Substantial Completion for 5 previous projects similar scope and complexity;
2. A copy of the first page of each final pay application executed by the Architect for each of the five projects, contact names and current phone numbers of the Architect's and Owner's representatives for each of the five projects;
3. The resume of the proposed Project Manager, the proposed Superintendent, and any other relevant project staff.
4. A summary addressing the ranking criteria to assist the Owner in the evaluation.
5. The electronic copies shall be a single bookmarked PDF files organized in the same manner as the printed hard copy.

The Owner may make such investigations as deemed necessary and request additional information from the contractor to determine the ability of the proposer to perform the Work. The Proposer shall furnish all such information and data for the purpose as may be requested. The Owner reserves the right to reject any proposal if the evidence submitted by, or investigation of, such proposer fails to satisfy the Owner that such proposer is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated above.

A committee consisting of Alvin ISD Administrators and the Architect with their consultants will make an initial evaluation of the Proposals to determine the number one ranked firm.

By submitting a proposal, each proposer agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal; waiver of any requirements under the Proposal Documents or the Contact Documents; acceptance or rejection of any proposals; and award of the contract.

Ranking Criteria

The Owner will use the following criteria for ranking the proposals and for designating the higher ranked Proposers with which it desires to negotiate. Each total score will be converted to a percentage grade of 0%-100% by dividing the total actual score by the total possible score. Upon ranking of the firms, the Owner shall enter into negotiations with the proposer that has the lowest proposed Base Bid price with all accepted Alternates and an evaluation grade of 80% or better. This proposer will be ranked as the number one firm with each of the higher priced proposers (with a score of 80% or better) given ranking of 2nd, 3rd, 4th, etc... If negotiations are unsuccessful, the Owner may continue negotiating with Proposers in order of rank until a contract at a price acceptable to the Owner is agreed upon. The Owner reserves the right to exclude Proposers failing to achieve a minimum total score of 80% from any further consideration for negotiation. The highest ranking firm with which the Owner negotiates a contract at a price acceptable to the Owner will be deemed the Proposer offering the best value to the Owner.

NOTE: In the event that two or more contractors propose the same total price: the contractor scoring

highest on Question #10 will be ranked higher.

STANDARD - CLOSED SEALED PROPOSAL (CSP) - RANKING CRITERIA

1 – Team Orientation & Firm Philosophy – References are asked to evaluate the Contractor's Teamwork and overall firm philosophy on Competitive Sealed Proposals.
10 Points per Reference 1.0 Factor 10 Total Points Available
Preferred References (minimum 5) shall be provided BY PROPOSER in Qualification Documents. The evaluator may also select additional references as necessary. Responses from multiple references are averaged and compared with references of other Proposers.

2 – Quality of Work – References are asked to evaluate the Contractor's Quality of Work
10 Points per Reference 1.5 Factor 15 Total Points Available
Preferred References (minimum 5) shall be provided BY PROPOSER in Qualification Documents. The evaluator may also select additional references as necessary. Responses from multiple references are averaged and compared with references of other Proposers

3 – Maintaining Schedule – References are asked whether or not schedules and milestones were met
10 Points per Reference 1.5 Factor 15 Total Points Available
Preferred References (minimum 5) shall be listed BY PROPOSER in Qualification Documents. The evaluator may also select additional references as necessary. Responses from multiple references are averaged and compared with references of other Proposers

4 – Change Orders – References are asked to evaluate the Contractor on response time and overall pricing received by Change Orders and other Proposals
10 Points per Reference 1.0 Factor 10 Total Points Available
Preferred References (minimum 5) shall be listed BY PROPOSER in Qualification Documents. The evaluator may also select additional references as necessary. Responses from multiple references are averaged and compared with references of other Proposers

5 – Warranty Work – References are asked whether or not warranty work was responded to and completed in a timely and proficient manner.
10 Points per Reference 1.5 Factor 15 Total Points Available
Preferred References (minimum 5) shall be listed BY PROPOSER in Qualification Documents. The evaluator may also select additional references as necessary. Responses from multiple references are averaged and compared with references of other Proposers

6 – Client Satisfaction – References are asked whether or not they wish to work with the Contractor again.
10 Points per Reference 1.0 Factor 10 Total Points Available
Preferred References (minimum 5) shall be chosen BY PROPOSER in Qualification Documents. The evaluator may also select additional references as necessary. Responses from multiple references are averaged and compared with references of other Proposers

7 – Time in Business & Overall Experience – Evaluation Team will acquire the year of establishment from the AIA305 submitted by Contractor and count the number of CSP projects of comparable size and scope completed within the last 10 years.
10 Points per Reference 1.5 Factor 15 Total Points Available
Contractors with less than 10 years in business under their current name will only receive a score of 1 for each project completed of comparable size and scope. Contractors with more than 10 years in business under their current name will receive a score of 5 plus an additional score of 1 for each project completed of comparable size and scope.

8 – Proposed Project Management – Resumes for proposed Project Manager and any Asst Project Managers will be evaluated and compared with those submitted by other Proposers.
10 Points per Reference 1.0 Factor 10 Total Points Available
Contractor to provide comprehensive resume and contact names and telephone numbers for references on applicable projects completed.

9 – Proposed On-Site Supervision – Resume for proposed Project Superintendent and any

Asst Superintendents will be evaluated and compared with those submitted by other Proposers.

10 Points per Reference 1.0 Factor 10 Total Points Available

Contractor to provide comprehensive resume and contact names and telephone numbers for references on applicable projects completed.

10 – Experience with Alvin ISD within the Past 10 Years – Proposer provides to Owner a list of projects completed with Alvin ISD.

10 Points per Reference 1.5 Factor 15 Total Points Available

Contractor with no experience with District will be given a score of 5. Good experience will be given a score of 6-10, bad experience will be given a score of 0-4

Total Possible Score	125
Percent Score	100%

END OF SECTION

SECTION 00 31 32 - GEOTECHNICAL DATA

PART 1 GENERAL

1.1 SOIL INVESTIGATION DATA

A. Investigation and Report:

After soil and subsurface investigations were conducted at the Project site, the Owner has obtained a geotechnical report, No. AS255004 issued by Terracon Consultants, Inc. , dated April 4, 2025 and supplemental report dated June 13, 2025. Both are available to bidders directly from the Owner if not included within the Project Manual. Soil investigation data is not a part of the Contract Documents.

Proposers are urged to examine soils investigation data and to make their own investigation of the site before submitting proposals.

B. Interpretation of Report:

Neither the Owner nor the Consultants warrant the accuracy or the completeness of the report. In submitting a tender, the Bidder acknowledges and represents that it has reviewed the report and has made its' own independent assessment of the conditions of the site and the requirement of the work, and that it is solely responsible for decisions pertaining to implementation of the geotechnical recommendations.

END OF SECTION: Plus Attached Reports

New Elementary School #23 Site

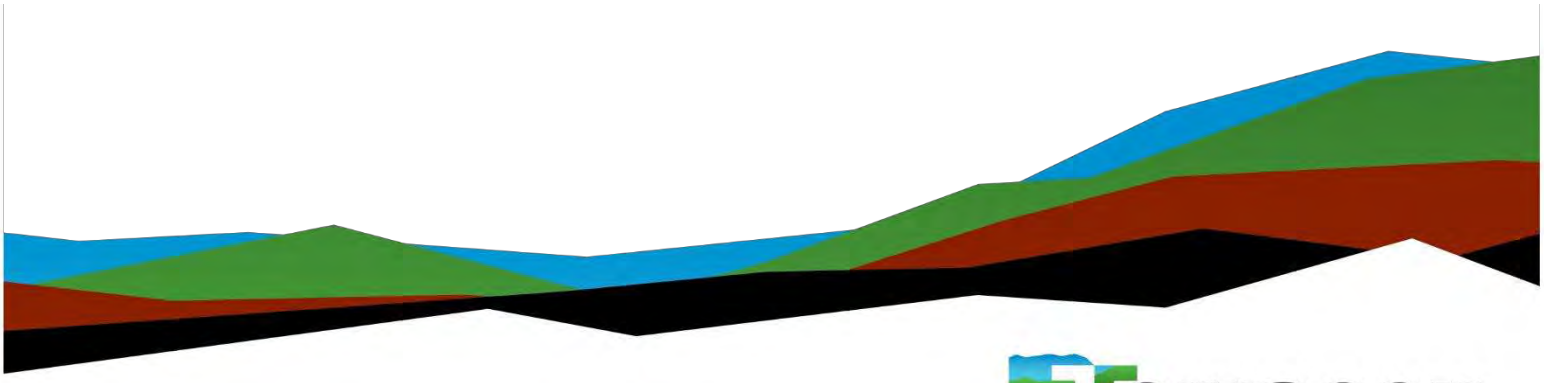
Geotechnical Engineering Report

April 4, 2025 | Terracon Project No. AS255004

Iowa Colony, Texas

Prepared for:

Alvin ISD
2200 Stapp Maxwell Street, Building A
Alvin, Texas 77511



Terracon
Explore with us

Nationwide
Terracon.com

- Facilities
- Environmental
- Geotechnical
- Materials

22535 N Highway 288-B
Angleton, TX 77515
P (979) 202-1113
Terracon.com

April 4, 2025

Alvin ISD
2200 Stapp Maxwell Street, Building A
Alvin, Texas 77511

Attn: Mr. Bill VanWagner
E:bvanwagner@alvinisd.net

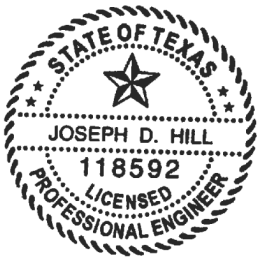
Re: Geotechnical Engineering Report
New Elementary School #23 Site
Iowa Colony, Texas
Terracon Project No. AS255004

Dear Mr. VanWagner:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Document No. PAS255004 dated February 3, 2025. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
(Texas Firm Registration No.: F-3272)



Ramses Macias, E.I.T.
Senior Staff Engineer

Joseph D. Hill, P.E.
Senior Associate

Table of Contents

Introduction **2**
Project Description **2**
Site Conditions **3**
Geotechnical Characterization **4**
Geology 4
Subsurface Profile 4
Groundwater Conditions 5
Geotechnical Overview **6**
Earthwork **8**
Site Preparation 8
Existing Fill 8
Fill Material Types 9
Fill Compaction Requirements 10
Utility Trench Backfill 10
Grading and Drainage 10
Wet Weather/Soft subgrade Considerations 11
Shallow Foundations **11**
Design Recommendations – Shallow Spread-Strip Footings 12
Construction Considerations – Shallow Foundations 13
Design Recommendations – Drilled-and-Underreamed Footings 13
Construction Considerations – Drilled-and-Underreamed Footings 15
Grade Beams – Drilled-and-Underreamed Footings 16
Foundation Construction Monitoring 16
FLOOR SLABS **16**
Pavements **18**
General Comments **23**

Figures

GeoModel

Attachments

Exploration and Testing Procedures
Site Location and Exploration Plans
Exploration and Laboratory Results
Supporting Information

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed construction of a New Elementary School campus in Iowa Colony, Texas. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Earthwork recommendations including site/subgrade preparation
- Recommended foundation options and engineering design parameters
- Estimated settlement of foundations
- Pavement design guidelines

The geotechnical engineering Scope of Services for this project included the advancement of 14 test borings (BH-01 through BH-14) to depths ranging from approximately 15 to 40 feet below existing grade, laboratory testing, engineering analysis, and preparation of this report.

Terracon previously performed geotechnical engineering services and provided geotechnical engineering report (Project No. 91205027A, dated August 10, 2020) for this site. The field and laboratory data from this project was used to supplement the information for this report.

Maps showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs in the **Exploration Results** section.

Project Description

Our initial understanding of the project was provided in our document and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	A request for quote email and a site location map were received on January 31, 2025.
Project Description	We understand that the proposed development is planned to include a new two-story elementary school building with a footprint area of about 70,300 square feet and associated pavement and driveways.

Item	Description
Proposed Foundations	Drilled-and-underreamed footings Shallow spread footings
Finished Floor Elevation	Within up to 2 feet above the existing grade.
Maximum Loads	▪ Columns: 100 kips ▪ Slabs: 125 pounds per square foot (psf)
Pavements	We assume both rigid (concrete) and flexible (asphalt) pavement sections will be considered. Anticipated traffic is planned to consist primarily of passenger and school vehicles in the parking areas. Passenger and school vehicles combined with garbage trucks and large multi-axle delivery trucks from time-to-time in the driveway areas.

Terracon should be notified if any of the above information is inconsistent with the planned construction, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration.

Item	Description
Parcel Information	The project site is located approximately 700 feet northwest of the intersection of White Gold Drive and Karsten Road in Iowa Colony, Texas. (See **Exhibit D**)
Existing Improvements	At the time of our field exploration, a detention pond was located on the south side of the site. The rest of the site was vacant.
Current Ground Cover	Grass, weeds, and exposed subgrade
Existing Topography	Relatively level

Geotechnical Characterization

Geology

Based on the geologic maps published by the Bureau of Economic Geology, the site for the proposed construction is located on the Beaumont formation, a deltaic nonmarine Pleistocene deposit. The Beaumont formation is heterogeneous containing thick interbedded layers of clay, fine sand, and silt.

The clay fraction is primarily composed of montmorillonite, illite, kaolinite, and finely ground quartz. The clay present in the formation has been preconsolidated by a process of desiccation. Numerous wetting and drying cycles have produced a network of small randomly oriented, closely-spaced joints within some depth zones. These small joints frequently have a shiny appearance; the clays are called slickensided in these cases. The joint pattern may have an influence on the construction and engineering behavior of the soil.

The coastal plain in this region has a complex tectonic geology, several major features of which are: Gulf Coastal geosyncline, salt domes, and major sea level fluctuations during the glacial stages, subsidence and geologic faulting activities. Most of these geologic faulting activities have ceased for millions of years, but some are still active.

Subsurface Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Fill – Fat Clay and Lean Clay	Reddish brown, tan, gray and dark gray, with calcareous and ferrous nodules, sand pockets and slickensides
2	Fat Clay	Dark gray, gray, tan and reddish brown, medium stiff to very stiff, with calcareous and ferrous nodules, sand pockets, silt seams, and slickensides
3	Sandy Lean Clay and Lean Clay	Reddish brown and tan, soft to stiff with silt and sand seams
4	Clayey Sand, Silty Sand, and Sandy Silt	Tan, loose to dense, with clay pockets

Groundwater Conditions

To evaluate groundwater conditions at the time of our field program, Borings BH-01 through BH-14 were advanced using dry drilling techniques to their termination depths (about 15 to 40 feet) in an effort to evaluate groundwater conditions at the time of our field program. Upon reaching groundwater, drilling was suspended for a period of about 15 minutes to allow the groundwater to rise and the groundwater levels to be recorded.

The water levels observed in the boreholes can be found on the boring logs in **Exploration Results** and are summarized below.

Summary of Groundwater Level Observations					
Boring No.	Approximate Boring Depth (feet)[1]	Approximate Depth of Dry Drilling (feet)[1]	Approximate Depth of Groundwater Below Existing Grade		
			Initial/During Dry Drilling	After 5 Minutes	After 15 Minutes
BH-01	40	40	30	24	23
BH-02	40	40	30	18	16
BH-03	40	40	30	22	21½
BH-04	40	40	35	21½	20
BH-05	40	40	35	24	23½
BH-06	40	40	35	30	28½
BH-07	40	40	30	21	20½
BH-08	40	40	35	23	22

Summary of Groundwater Level Observations					
Boring No.	**Approximate Boring Depth (feet)[1]**	**Approximate Depth of Dry Drilling (feet)[1]**	**Approximate Depth of Groundwater Below Existing Grade**		
			Initial/During Dry Drilling	**After 5 Minutes**	**After 15 Minutes**
BH-09	15	15	Groundwater not observed		
BH-10	15	15			
BH-11	15	15			
BH-12	15	15			
BH-13	15	15			
BH-14	15	15			

1. Below existing grade.
2. Groundwater readings were obtained on March 20, 2025.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project and should be evaluated prior to construction.

Geotechnical Overview

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project. A summary of our findings and recommendations is provided below.

- Fill soils were observed at the ground surface at borings BH-1 through BH-14 and extended approximately 2 to 10 feet below existing grade. Fill soils may be observed at varying depths at other locations within the site not explored during our field program. Support of the floor slabs on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risk of increased differential performance which can result in increased cracking and abrupt differential settlement. Should this risk be acceptable, floor slabs and pavements can be supported above the fill.

- We recommend that the fill soils be over-excavated and completely removed within the proposed building area to expose the underlying native subsurface soils.

- Expansive soils were observed at this site. This report provides recommendations to help reduce the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and distress in the proposed building should be anticipated. The severity of distress will increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement associated with expansive soils may not be feasible. However, this risk can be significantly reduced if the building is designed as a structural slab over a void space with the structural loads supported by a foundation system terminated below the active zone. Terracon can provide recommendations for this option, if requested.

- A foundation system consisting of drilled-and-underreamed or shallow spread footings should be utilized to support the proposed building planned at this site.

- A minimum 60-inch thick select fill pad should be placed under the proposed building to provide uniform support to the floor slab and to reduce the estimated Potential Vertical Rise (PVR) to approximately one inch or less.

- Flexible pavement sections vary from 2 to 2½ inches of asphaltic concrete over 8 to 10 inches of base material with chemically treated subgrade.

- Rigid pavement sections vary from 5 to 7 inches of reinforced concrete with chemically treated subgrade.

- The top 6 inched of the subgrade just below the proposed pavement should be chemically treated with lime. We recommend that about 8 to 10 percent lime be used for estimation and planning. The percentage are given as application by dry weight and are typically equivalent to about 40 to 50 pounds of lime per square yard per 6-inch depth.

- Pavement areas placed upon the deeper fill soils, such as observed at borings BH-09, BH-11, B-13,and BH-14 will also be subject to future settlement of the fill. Complete excavation, removal, and recompaction of the fill soils in the pavement areas would reduce the potential for future settlement; however, complete excavation and removal of the fill soil within the proposed pavement areas would likely not be feasible. As an alternative, the settlement potential can be reduced by reworking the upper two to three feet of fill below the pavement areas if deep fills soils are observed (or up to the underlying native soils, whichever occurs first) to reduce differential settlements, with the understanding that some settlement (which will likely result in increased maintenance of pavements) may occur.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Construction areas should be stripped of vegetation, topsoil, and other debris/unsuitable surface material. Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Once final subgrade elevations have been achieved, the exposed subgrade should be carefully proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Special care should be exercised when proofrolling areas containing fill soils in an attempt to observe soft/weak zones within the fill soils. Weak areas detected during proofrolling, as well as zones of fill containing organic matter and/or debris, should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proofrolling should be performed under the direct observation of the geotechnical engineer or his/her representative.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction area should be evaluated for moisture and density. If the moisture and/or density do not meet the criteria described in **Fill Compaction Requirements** for on-site soils, the subgrade should be scarified to a minimum depth of 6 inches, moisture adjusted, and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.

Existing Fill

We recommend that the fill soils be over-excavated and completely removed within the proposed building area to expose the underlying native subsurface soils. Select fill soils should be used to raise grade up in the proposed building area.

Pavement areas placed upon the deeper fill soils, such as observed at borings BH-09, BH-11, B-13,and BH-14 will also be subject to future settlement of the fill. Complete excavation, removal, and recompaction of the fill soils in the pavement areas would reduce the potential for future settlement; however, complete excavation and removal of the fill soil within the proposed pavement areas would likely not be feasible. As an alternative, the settlement potential can be reduced by reworking the upper two to three feet of fill below the pavement areas if deep fills soils are observed (or up to the underlying native soils, whichever occurs first) to reduce differential settlements, with the understanding that some settlement (which will likely result in increased maintenance of pavements) may occur.

Fill Material Types

Select fill and on-site soils to be used at this site for grade adjustments should meet the following criteria:

Fill Type	USCS Classification	Acceptable Location for Placement
Select fill soils	CL and/or SC (10≤PI≤20)	Must be used to construct the select fill building pad under the floor slab and for all grade adjustments within the building areas.
On-site soils	Varies	The on-site soils, including the undocumented fill soils, appear suitable for use as fill within the pavement areas, provided they are free of organics and debris.

If blended or mixed soils are intended for use as select fill, Terracon should be contacted to provide additional recommendations. Blended or mixed soils do not occur naturally. These soils are a blend of sand and clay and will require mechanical mixing at the site with a pulvimixer. If these soils are not mixed thoroughly to break down the clay clods and blend-in the sand to produce a uniform soil matrix, the fill material may be detrimental to the performance of the foundations. If blended soils are used, we recommend that additional samples of the blended soils as well as the clay clods, be obtained prior to and during earthwork operations to evaluate if the blended soils can be used in lieu of select fill. The actual type and amount of mechanical mixing at the site will depend on the amount of clay and sand, and properties of the clay.

Fill Compaction Requirements

Item	Description
Fill lift thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thicknesses not to exceed 6 inches.
Compaction requirements	■ Select fill and on-site placed within 4 feet of final grade should be compacted to 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ Select fill and on-site placed below 4 feet below final grade should be compacted to 100 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill soils should be moisture adjusted to within 2 percent of the optimum moisture content. ■ The on-site clay soils should be moisture conditioned to between optimum and +4 percent of the optimum moisture content.

Prior to any filling operations, samples of the proposed borrow and on-site materials should be obtained for laboratory moisture-density testing. The tests will provide a basis for evaluation of fill compaction by in-place density testing. A qualified soil technician should perform sufficient in-place density tests during the filling operations to evaluate that proper levels of compaction, including dry unit weight and moisture content, are being attained.

Utility Trench Backfill

Utility trenches are a common source of water infiltration and mitigation. All utility trenches that penetrate beneath the structure should effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building. We recommend constructing and effective clay "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted at a water content at or above the soils optimum water content. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report.

Grading and Drainage

All grades must provide effective drainage away from the proposed structures during and after construction. Water permitted to pond next to the buildings can result in distress in the buildings. These greater movements can result in unacceptable differential slab movements, cracked slabs and walls, and roof leaks. Slabs and

foundation performances described in this report are based on effective drainage for the life of the buildings and cannot be relied upon if effective drainage is not maintained.

Exposed ground should be sloped away from the buildings for at least 10 feet beyond the perimeter of the buildings. After construction and landscaping, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the buildings should also be periodically inspected and adjusted as necessary, as part of the buildings' maintenance program.

Planters located within 10 feet of the proposed buildings should be self-contained to prevent water accessing the buildings subgrade soils. Locate sprinkler mains and spray heads a minimum of 5 feet away from the building lines. Low-volume, drip-style landscaped irrigation should not be used near the building. Collect roof runoff in drains or gutters. Discharge roof drains and downspouts onto pavements and/or flatworks which slope away from the structures or extend down spouts a minimum of 10 feet away from the buildings.

Flatworks will be subject to post construction movement. Maximum grades practical should be used for flatwork to prevent water from ponding. Allowances in final grades should also consider post-construction movement of flatwork, particularly if such movement would be critical. Where flatwork abuts the buildings, effectively seal and maintain joints to prevent surface water infiltration.

Wet Weather/Soft subgrade Considerations

Construction operations may encounter difficulties due to wet or soft surface soils becoming a general hindrance to equipment, especially following periods of wet weather. If the subgrade cannot be adequately compacted to the minimum densities as described previously, one of the following measures will be required: 1) removal and replacement with select fill, 2) chemical treatment of the soil to dry and improve the condition of the subgrade, or 3) drying by natural means if the schedule allows. Based on our experience with similar soils in this area, chemical treatment is generally an efficient and effective method to improve the condition of wet and weak subgrade. Terracon should be contacted for additional recommendations if chemical treatment is needed due to soft and wet subgrade.

Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Recommendations – Shallow Spread-Strip Footings

Item	Description
Minimum embedment depth[1]	3 feet below final grade
Allowable bearing pressures (individual footings)[2]	Net dead plus sustained live load – 2,300 psf Net total load – 3,400 psf
Allowable bearing pressure (strip footing)[3]	Net total load – 2,300 psf
Approximate post-construction settlement[4]	Approximately one inch
Estimated post-construction differential settlement[5]	Approximately ½ of post-construction settlement
Allowable passive pressure[6]	750 psf
Allowable frictional resistance[7]	250 psf
Uplift resistance[8]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should bear upon the properly placed and compacted select fill soils.
2. Whichever condition yields a larger bearing area.
3. Defined as a footing at least twice as long as it is wide.
4. This estimated post-construction settlement of the shallow footings is based on proper construction practices being followed. A clear distance between footings of one footing size of the larger of the two footings should not produce overlapping stress distributions and would essentially behave as independent foundations. If shallow footing widths are planned to be greater than 10 feet, Terracon should be contacted to perform additional settlement analyses.
5. The post-construction differential settlements may result from variances in subsurface conditions, loading conditions, and construction procedures. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads.
6. The passive pressure along the exterior face of the footings should be neglected within the upper 4 feet due to surface effects and the presence of fill and expansive soils unless pavement is provided up to the edge of the structures. For interior footings, the allowable passive pressure may be used for the entire depth of the footing.
7. To be utilized on the base of the footings.
8. Structural uplift loads on the shallow footings may be resisted by the weight of the foundation plus the weight of any soil directly above the foundation. The ultimate uplift capacity of shallow footings should be reduced by an appropriate factor of safety to compute allowable uplift capacity.

Construction Considerations – Shallow Foundations

Excavations for the shallow foundations should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the excavations should be performed using a smooth-mouthed excavation bucket or by hand labor. The excavations should be neatly excavated and properly formed. Disturbance of the bearing area of the foundations should be minimized during the excavation operations. Soft zones observed during construction should be over-excavated to a firm and undisturbed soil layer and all loose materials in the excavation bottom should be removed before placement of concrete. Water should not be allowed to accumulate at the bottom of the foundation excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavations are completed and properly cleaned. Excavations should not be left open for more than 24 hours. The bearing surface of the foundations should be evaluated immediately prior to placing concrete.

A thin seal slab (approximately 2 to 4 inches thick) should be placed at the bottom of the footing excavation to protect the bearing surface of the footing from disturbance if the footing cannot be poured within 24 hours following excavation.

Design Recommendations – Drilled-and-Underreamed Footings

Item	Description
Minimum embedment depth[1]	10 feet below existing grade (grade at the time of our field program)
Allowable bearing pressures[2]	Net dead plus sustained live load – 2,800 psf Net total load – 4,200 psf
Maximum underream-to-shaft diameter ratio	3:1
Minimum underream-to-shaft diameter ratio[3]	2:1
Estimated uplift pressure due to post-construction heave of the clay soils[4]	1,000 psf
Minimum percentage of steel[5]	0.5 percent
Approximate post-construction settlement[6]	one inch or less
Estimated differential settlement[7]	Approximately ½ of post-construction settlement
Allowable passive pressure[8]	1,000 psf

Item	Description
Uplift resistance[9]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should bear within the native undisturbed clay soils.
2. Whichever condition yields a larger bearing area.
3. This minimum underream-to-shaft diameter ratio should result in a large enough diameter of the underream to overcome uplift forces on the footing without casing local soil failure to the overlying soils.
4. The magnitude of uplift is difficult to predict and will vary with in-situ moisture contents. This uplift pressure can be approximated over the entire perimeter of the shaft above the top of the underream up to the bottom of the select fill pad.
5. The footings should contain sufficient vertical reinforcing steel throughout the entire shaft length to resist uplift (tensile) forces due to post-construction heave of the clay soils. The amount of reinforcing steel required can be computed by assuming that the dead load of the structure surcharges the footing, that the above estimated tensile force acts vertically on the shaft, and that the underream acts as a rigid anchor.
6. This estimated post-construction settlement of the drilled-and-underreamed footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are being followed. A clear distance between the footings of one underream diameter of the larger footing should be provided between the underreams to develop the recommended bearing pressures and to control settlements. If a clearance of one diameter cannot be maintained in every case, the above bearing capacities should be reduced by 20 percent for a clearance between one half and one underream diameters. Underreams closer than a clearance of one half of an underream diameter are not recommended.
7. The differential settlement will result from variances in subsurface conditions, loading conditions and construction procedures, such a cleanliness of the bearing area or flowing water in the shaft.
8. For footings placed against an undisturbed vertical face of the in-situ soils. Lateral resistance of the drilled-and-underreamed footings is primarily developed by passive resistance of the soils against the side of the footing. Due to surface effects and the presence of fill and expansive soils, the lateral resistance of the upper 4 feet of the soils at the surface for exterior footings should be neglected unless area paving is provided up to the edge of the building.
9. Structural uplift loads on the drilled-and-underreamed footings will be resisted by the dead weight of the footings and supported structure plus the weight of a soil wedge above the footing. The soil wedge can be assumed to extend upward from the bottom of the underream at a slope of 4 vertical to 1 horizontal.

Construction Considerations – Drilled-and-Underreamed Footings

Drilled excavations to a depth of 10 feet below existing grade will be necessary for installation of drilled-and-underreamed footings for the proposed buildings planned at this site. The excavations should be performed with equipment capable of providing a relatively clean bearing area. The presence of secondary structures such as silt and sand pockets, ferrous and calcareous nodules, etc., can cause sloughing during footing excavation. Thus, the drilling contractor should have casing available in the event that sloughing causes improperly formed shafts.

Based on our groundwater observations, groundwater was not observed at borings BH-01 through BH-08 within the recommended bearing depth and is not expected to be a major concern during construction at the recommended bearing depth. However, depending on climatic conditions, groundwater levels may vary from the levels observed during our field program as shown on boring locations performed for this site in project (Terracon Project No. 91205027A). Water must not be allowed to accumulate in the bottom of the footing excavations. The contractor should be prepared to remove water from the drilled footings, if necessary. To reduce the potential for water seepage into the footing excavation and to minimize disturbance to the bearing area, we recommend that concrete and steel be placed as soon as possible after footing excavations are completed. Preferably, footing excavations should be backfilled with concrete within about 2 to 4 hours of completion of the drilling and in no case should an excavation be left open overnight. The concrete placed in the excavations should have a 6-inch slump with a plus or minus one inch tolerance. The bottom of each footing excavation should be free of all loose materials and/or water, and the bearing surface should be evaluated immediately prior to placing concrete.

Based on the available field and laboratory data, the underreams constructed as described in this report should remain stable for a short period of time. However, if underreams are marginally stable due to water seepage and/or the presence of sloughing soils, successful construction of underreamed footings may be possible by performing the sequence of construction without interruption, that is, each footing drilled, underreamed, and backfilled with concrete in one continuous operation. The contractor must coordinate the operation very closely to have concrete on site at the time each footing is drilled and underreamed so that no shaft or underream is drilled without concrete standing by, ready to be placed. Additional measures to reduce the potential for caving of the underream would be to limit the underream-to-shaft diameter ratio to 2.5:1 or 2:1 or to install straight shaft footings in isolated problem areas. If straight shaft footings are planned at the site, Terracon should be contacted for additional recommendations.

Grade Beams – Drilled-and-Underreamed Footings

Grade beams associated with the drilled-and-underreamed footings should be designed to span between the footings without subgrade support. Often, a vertical void of about 6 to 8 inches is provided beneath the grade beams in clay soils such as those observed at this site. However, recent experience indicates that the voids beneath the grade beams often fill with water, providing moisture to the surrounding subgrade. Therefore, provided that the subgrade is prepared as recommended in this report, grade beams may be constructed without a void at this site. However, due to the underlying clay soils, nominal upward movement of the grade beams may occur during moisture variations of the subgrade.

If construction of voids beneath the grade beams is planned, proper construction of the voids and soil retainers is very important. If a cardboard carton system is used on this project, we recommend that the carton form supplier provide, during the initial concrete operations, a representative to instruct the work force on the proper installation methods for both the forms and the concrete. In addition, measures should be implemented to provide proper surface drainage away from the structures to reduce the potential for water to access the voids.

Backfill against the outside face of the grade beams should consist of select fill used to prepare the building pad. The select fill should be uniformly compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 2 percent of optimum moisture content.

Foundation Construction Monitoring

The performance of the foundation systems will be highly dependent upon the quality of construction. Thus, we recommend that subgrade preparation, fill compaction, and foundation installation be observed full time by an experienced Terracon soil technician under the direction of our geotechnical engineer. During foundation construction, the base of the footing excavations should be observed to evaluate the condition of the subgrade. We would be pleased to develop a plan for compaction and foundation installation observation to be incorporated in the overall quality control program.

Floor Slabs

Planned finished grades for the proposed building were not available at the time of this report. We anticipate that the finished floor elevation of the proposed building is planned to be within about 2 feet of existing grade. If the grading is planned to be altered from what has been previously described, Terracon should be notified to review and/or modify our recommendations given in this subsection.

Due to the amount of fill observed at this site, we recommend that the fill soils be over-excavated and completely removed within the proposed building area. The exposed subgrade after over-excavation should be thoroughly proofrolled and prepared as outlined in the **Earthwork** section of this report (including evaluated for moisture and density). Select fill soils should be used to raise grade up in the proposed building area.

The near-surface soils observed at this site generally exhibit a high expansion potential. These soils can subject the interior floor slab of the building to significant movements (due to shrinking and swelling) with fluctuations in their moisture content. This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of the moisture contents throughout the life of the building. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to approximately 4¾ inches. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the grade-supported floor slabs. The corresponding decrease in the potential soil movements is primarily a function of the fill pad thickness and the moisture levels of the underlying clay subgrade. While the indicated preparations do not eliminate the potential for soil movement, the magnitude of such movements should be reduced to more acceptable levels. To provide uniform support to the floor slab and to reduce the estimated PVR to approximately one inch or less, we recommend that a minimum 60 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slab. The select fill pad should extend a minimum of 5 feet beyond the edge of the building area. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the structure.

Select fill should be utilized for all grade adjustments within the proposed building area. The subgrade and select fill soils should be prepared as outlined in the **Earthwork** section of this report, which contains material and placement requirements for select fill, as well as other subgrade preparation recommendations.

The subgrade soils for flatwork outside of the structure which will be sensitive to movement should be prepared as discussed previously. This preparation will be important on surrounding sidewalks and paving immediately adjacent to the structure. If these adjacent flatwork areas are not prepared as stated above for the building area, the

estimated PVR for these areas could approach those indicated previously for in-situ conditions. If the soils swell in these areas, this movement could result in significant distress to the adjacent sidewalks and paving and possibly result in reversed drainage (flow of runoff toward the structure) around the perimeter of the structure.

Pavements

Once the subgrade is properly prepared, both flexible pavement systems (consisting of asphaltic concrete and base material) and rigid pavement systems may be considered for this project. Detailed traffic loads and frequencies were not available at the time of this report. However, we anticipate that the traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks and large multi-axle delivery trucks from time-to-time in driveway areas.

Tabulated in the following table are the assumed traffic frequencies and loads used to design pavement sections for this project. When actual traffic conditions have been determined, Terracon should be contacted to review the information to consider a need for revision of the pavement designs and related recommendations.

Pavement Area	Traffic Design Index	Description
Automobile Parking Areas	DI-1	Light traffic (Few vehicles heavier than passenger cars, no regular use by heavily loaded two axle trucks.) (EAL[1] < 6)
Driveways (Light Duty)	DI-2	Medium to light traffic (Similar to DI-1 including not over 50 loaded two axle trucks or lightly loaded larger vehicles per day. No regular use by heavily loaded trucks with three or more axles.) (EAL[1] = 6-20)
Driveways and Truck Traffic Areas (Medium Duty)	DI-3	Medium traffic (Including not over 300 heavily loaded two axle trucks plus lightly loaded trucks with three or more axles and no more than 30 heavily loaded trucks with more than three axles per day.) (EAL[1] = 21-75)

1. Equivalent daily 18-kip single-axle load applications.

The top 6 inches of the finished subgrade soils directly beneath the pavement systems should be chemically treated with lime. The decision about the type and proper amount of additive should be made after the subgrade is open for inspection. Chemical treatment will increase the supporting value of the subgrade and decrease the effect of

moisture on subgrade soils. These 6 inches of treatment is a required part of the pavement design and is not a part of site and subgrade preparation for wet/soft subgrade conditions.

Listed in the following tables are flexible and rigid pavement component thicknesses, which may be used as a guide for pavement systems at the site for the traffic classifications stated herein. These systems were derived based on general characterization of the subgrade. Specific testing (such as CBR's, resilient modulus tests, etc.) was not performed for this project to evaluate the support characteristics of the subgrade.

Flexible Pavement System

Layer	Material Thickness (inches)	
	DI-1	DI-2
Asphaltic Concrete	2	2½
Base Material	8	10
Treated Subgrade	6	6

Rigid Pavement System

Layer	Material Thickness (inches)		
	DI-1	DI-2	DI-3
Reinforced Concrete	5	6	7
Treated Subgrade	6	6	6

Waste dumpster areas should be constructed of at least 7 inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection.

Presented in the following sections are our recommended material requirements for the various pavement sections.

Reinforced Concrete Pavement – The materials and properties of reinforced concrete pavement shall meet applicable requirements in the ACI Manual of Concrete Practice. The Portland cement concrete mix should have a minimum 28-day compressive strength of 3,500 psi.

If river gravel is planned to be utilized in the portland cement concrete mix, Terracon should be contacted for additional services. The presence of river gravel in the portland cement concrete mix can result in excessive cracking and distress to the concrete pavement as a result of differing thermal expansion properties between the river gravel and cement paste. Special care should be taken in developing the project's Portland cement concrete mix design, joint layout, and placement to help reduce the potential for excessive cracking and distress if river gravel is planned to be utilized for the project.

Reinforcing Steel – ACI recommendations indicate that distributed steel reinforcement is not necessary when the pavement is properly jointed to form short panel lengths that will help reduce intermediate cracking. Provided the concrete pavement is designed and constructed as stated herein, the installation of reinforcing steel is optional and should be evaluated by the design team. Proper layout and installation of the joints within the pavement is critical to help control intermediate cracking.

If reinforcing steel is planned to be utilized in the concrete pavement by the design team, the following amount of reinforcing steel should be used as a guideline:

- DI-1: #3 bars spaced at 18 inches or #4 bars spaced at 24 inches on centers in both directions.
- DI-2: #3 bars spaced at 12 inches or #4 bars spaced at 18 inches on centers in both directions.
- DI-3: #4 bars spaced at 18 inches on centers in both directions.

Control Joint Spacing – ACI recommendations indicate that control joints should be spaced at a maximum spacing of 30 times the thickness of the pavement for unreinforced parking lot pavements. Furthermore, ACI recommends a maximum control joint spacing of 12.5 feet for 5-inch pavements and a maximum control joint spacing of 15 feet for 6-inch or thicker pavements. Sawcut control joints should be cut within 4 to 12 hours of concrete placement to help control the formation of plastic shrinkage cracks as the concrete cures. The depth of the joint should be at least one-quarter of the slab depth when using a conventional saw or one inch when using early entry saws. The width of the cut should be in accordance with the joint sealant manufacturer recommendations.

Expansion Joint Spacing – ACI recommendations indicate that regularly spaced expansion joints may be deleted from concrete pavements. Therefore, the installation of expansion joints is optional and should be evaluated by the design team.

Construction Joints – When concrete is planned to be placed at different times, we recommend the use of a construction joint between paving areas. The construction joint should consist of a butt joint (not a keyway joint).

Concrete Curing Compound – A concrete curing compound, such as a Type 2 membrane curing compound conforming to TxDOT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" or equivalent, should be applied to the concrete surface immediately after placement of the concrete in accordance with TxDOT 2014 Standard Specifications Item 360.

Dowels at Expansion/Construction Joints – The dowels at expansion/construction joints should be spaced at 12-inch centers and consist of the following:

- DI-1: 5/8-inch diameter, 12-inches long with 5-inch embedment.
- DI-2: 3/4-inch diameter, 14-inches long with 6-inch embedment.
- DI-3: 7/8-inch diameter, 14-inches long with 6-inch embedment.

One end of the dowels should either be greased or sleeved to allow for lateral movement to occur.

Hot Mix Asphaltic Concrete Surface Course – The asphaltic concrete surface course should be plant mixed, hot laid Type D (Fine Graded Surface Course) meeting the specifications requirements in TxDOT 2014 Standard Specifications Item 340. Specific criteria for the job specifications should include compaction to within an air void range of 3.8 to 8.5 percent calculated using the maximum theoretical specific gravity mix measured by TxDOT Tex-227-F. The asphalt cement content by percent of total mixture weight should be within ± 0.5 percent asphalt cement from the job mix design.

Base Material – Base material should be composed of crushed limestone or crushed concrete meeting the requirements of TxDOT 2014 Standard Specifications Item 247, Type A or D, Grade 1-2. The base material should be compacted to at least 95 percent of the Modified Effort (ASTM D 1557) maximum dry density at moisture content within 2 percent of the optimum moisture content.

Lime Treated Subgrade – We anticipate that the pavement subgrade will generally consist of on-site medium to high plasticity clay soils. The pavement subgrade should be treated with lime in accordance with TXDOT 2014 Standard Specifications Item 260. Based on the classification test results, we recommend that approximately 8 to 10 percent lime by dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 40 to 50 pounds of lime per square yard per 6-inch depth. The actual quantity of lime should be determined at the time of construction based on lime determination tests conducted using bulk samples of the subgrade soils. The pulverization, mixing, and curing of the lime treated subgrade is of particular importance for the on-site clay soils. The subgrade should be compacted to a minimum of 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content between optimum and 4 percent wet of the optimum moisture content.

Preferably, traffic should be kept off the treated subgrade for about 7 days to facilitate curing of the soil-lime mixture; in addition, the subgrade is not suitable for heavy construction traffic prior to paving.

The pavement design methods described above are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. The support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade such as the soils observed at this site. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. Post-construction subgrade movements and some cracking of pavements are not uncommon for clay subgrade conditions such as those observed at this site. Reducing moisture changes in the subgrade is important to reduce shrink/swell movements. Although chemical treatment will help to reduce such movement/cracking, this movement/cracking cannot be feasibly eliminated.

Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations and environmental factors which will significantly affect the service life must be included in the preparation of the construction drawings and specifications. Normal periodic maintenance will be required.

Long-term pavement performance will be dependent upon several factors, including maintaining subgrade moisture levels and providing for preventative maintenance. The following recommendations should be implemented to help promote long-term pavement performance:

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent;
- Install joint sealant and seal cracks immediately;
- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section; and
- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.

Preventative maintenance should be planned and provided for the pavements at this site. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and consist of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Prior to implementing any maintenance, additional engineering observations are recommended to determine the type and extent of preventative maintenance.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and

recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

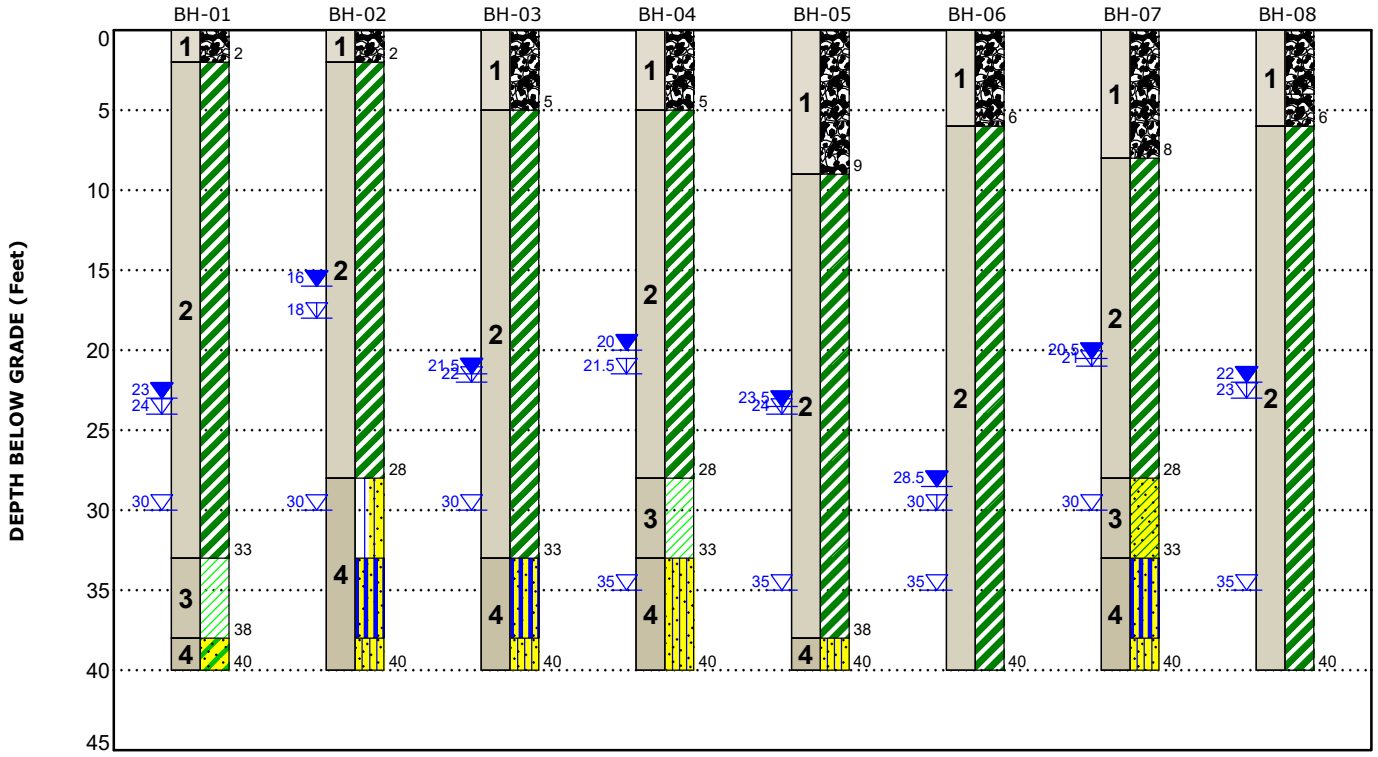
Contents:

GeoModel (2 pages)

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Fill - Fat Clay and Lean Clay**	reddish brown, tan, gray, and gark gray, with sand pockets, calcareous and ferrous nodules, and slickensides
2	**Fat Clay**	dark gray, gray, tan, and reddish brown, medium stiff to very stiff, with silt seams, calcareous and ferrous nodules, sand pockets, and slickensides
3	**Sandy Lean Clay and Lean Clay**	reddish brown and tan, soft to stiff, with silt and sand seams
4	**Clayey Sand, Silty Sand, and Sandy Silt**	tan, loose to dense, with clay pockets

Legend	
Fill	Fat Clay
Lean Clay	Clayey Sand
Silt with Sand	Sandy Silt
Silty Sand	Sandy Lean Clay

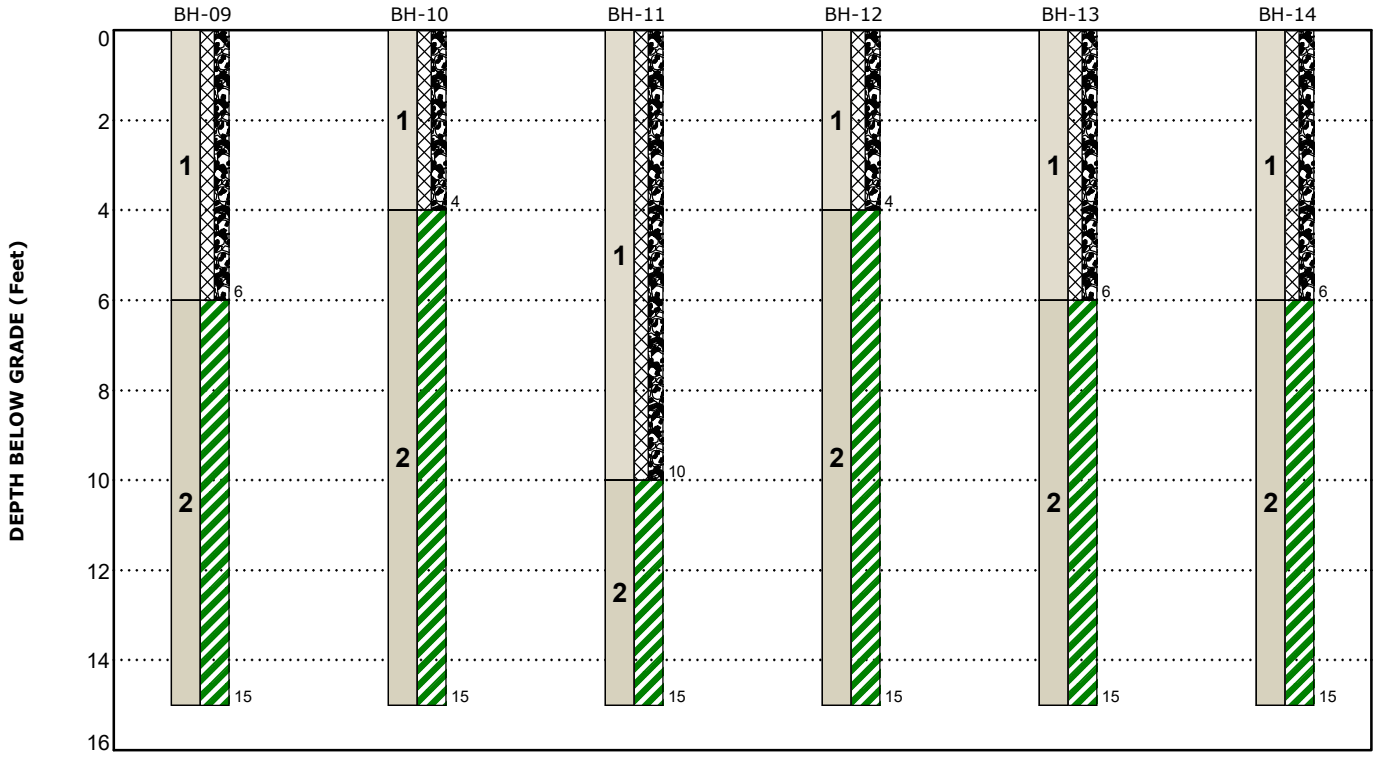
First Water Observation
Second Water Observation
Third Water Observation
Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Fill - Fat Clay and Lean Clay**	reddish brown, tan, gray, and gark gray, with sand pockets, calcareous and ferrous nodules, and slickensides
2	**Fat Clay**	dark gray, gray, tan, and reddish brown, medium stiff to very stiff, with silt seams, calcareous and ferrous nodules, sand pockets, and slickensides
3	**Sandy Lean Clay and Lean Clay**	reddish brown and tan, soft to stiff, with silt and sand seams
4	**Clayey Sand, Silty Sand, and Sandy Silt**	tan, loose to dense, with clay pockets

Legend

Fill
Fat Clay

▽ First Water Observation
▽ Second Water Observation
▼ Third Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
8 (BH-01 through BH-08)	40	Building area
6 (BH-09 through BH-14)	15	Pavement/driveway area

Boring Layout and Elevations: We used handheld Global Positioning System (GPS) equipment to locate the approximate latitude and longitude of the borings with an accuracy of +/-25 feet. The boring depths were measured from the existing ground surface at the time of our field activities.

Subsurface Exploration Procedures: We advanced the borings with an all-terrain vehicle (ATV) mounted drilling rig using dry auger techniques. Samples were obtained at 2-foot intervals in the upper 12 feet of each boring and at intervals of 5 feet thereafter. Soil sampling was typically performed using open-tube and/or split-barrel sampling procedures.

Cohesive soil samples were generally recovered using open-tube samplers. Hand penetrometer tests were performed on samples of cohesive soils in the field to serve as a general measure of consistency.

Granular soils and soils for which good quality open-tube samples could not be recovered were sampled by means of the Standard Penetration Test (SPT). This test consists of measuring the number of blows (N) required for a 140-pound hammer free falling 30 inches to drive a standard split-spoon sampler 12 inches into the subsurface material after being seated six inches. This blow count or SPT "N" value is used to evaluate the stratum. An automatic SPT hammer was used in advancing the split-spoon sampler at the borings. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT N-values and soil properties are based on the lower efficiency cathead and rope method. The higher efficiency of an automatic SPT hammer affects the SPT N-value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method.

The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. In addition, we observed and recorded

groundwater levels during drilling and sampling. We backfilled the borings with auger cuttings after completion.

Our exploration team prepared field boring logs as part of standard drilling operations including sampling depths, penetration distances, and other relevant sampling information. Field logs include visual classifications of materials observed during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent an interpretation of the field logs by a geotechnical engineer and include modifications based on laboratory observation and tests on select samples.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Unconfined Compression
- Atterberg Limits
- Percent Finer than No. 200 Sieve

The laboratory testing program included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Samples not tested in the laboratory will be stored for a period of 30 days subsequent to submittal of this report and will be discarded after this period, unless we are notified otherwise.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

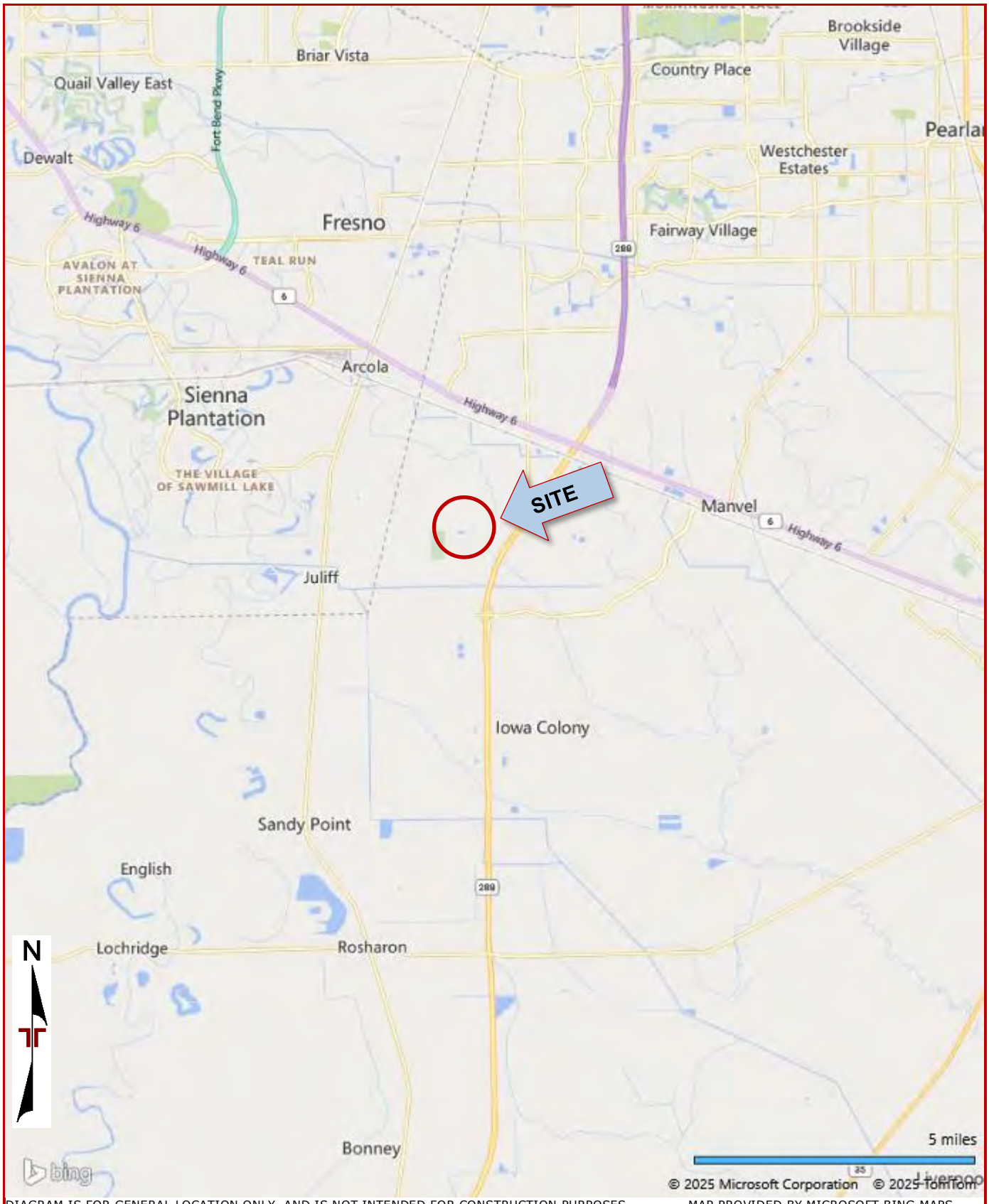


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

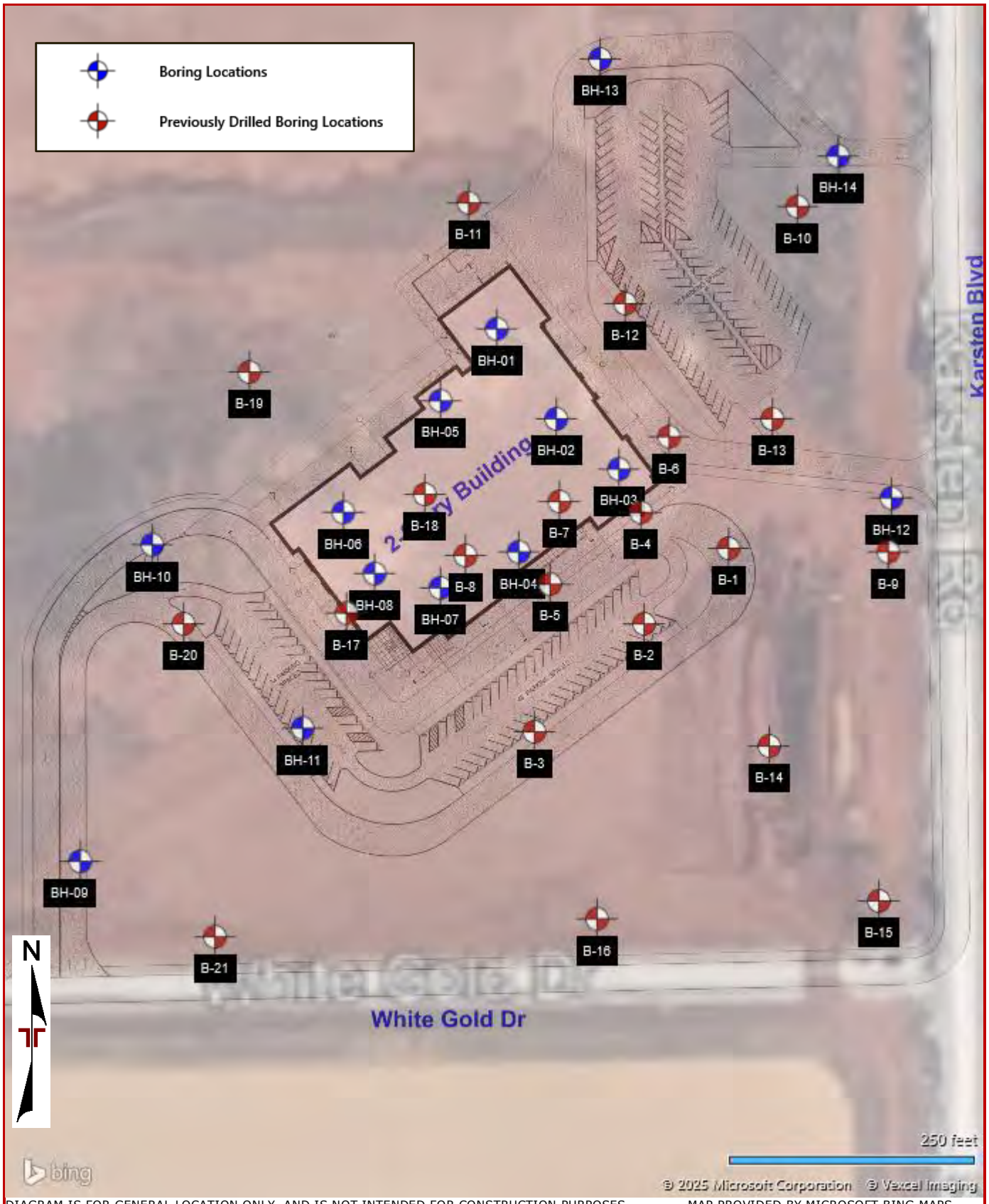


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (BH-01 through BH-14)

Note: All attachments are one page unless noted above.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-01

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4645° Longitude: -95.4329° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, reddish brown				1.25 (HP)							
		2.0											
2		**FAT CLAY (CH)**, dark gray, medium stiff to very stiff				1.25 (HP)				33.4		82-21-61	
		- with scattered roots 2 to 4 feet											
		- gray 4 to 13 feet - with slickensides 4 to 28 feet	5			1.5 (HP)	UC	1.03	5.5	40.5	81		
						1.0 (HP)				40.3		93-23-70	
						1.0 (HP)							
		- with ferrous nodules 10 to 28 feet	10			1.5 (HP)	UC	0.81	2.6	39.4	81		
		- gray and tan, with calcareous nodules 13 to 28 feet				1.25 (HP)				35.5			96.8
			15										
						1.75 (HP)							
			20										
				▼									
				▽		1.5 (HP)	UC	1.41	5.1	31.7	88		
			25										
		- reddish brown 28 to 33 feet				2.75 (HP)							
			30	▽									
		33.0											
3		**LEAN CLAY (CL)**, reddish brown, stiff, with silt seams				1.5 (HP)				23.0		34-15-19	95.7
			35										
		38.0											
4		**CLAYEY SAND (SC)**, tan, loose				3-3-5 N=8							
		40.0	40										
		Boring Terminated at 40 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ While drilling
▽ After 5 minutes
▼ After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-20-2025

Boring Completed
03-20-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-02

Location: See Exploration Plan

Latitude: 29.4643° Longitude: -95.4328°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		2.0	**FILL - FAT CLAY (CH)**, tan and reddish brwon				0.5 (HP)				41.8		77-23-54	
2			**FAT CLAY (CH)**, dark gray, medium stiff to very stiff - with scattered roots 2 to 4 feet - with calcareous nodules 4 to 8 feet				2.5 (HP)	UC	1.64	6.1	33.6	84		
				5			3.5 (HP)				23.4		80-22-58	
			- with slickensides 6 to 23 feet				2.5 (HP)							
							1.25 (HP)	UC	0.99	7.1	38.8	81		
				10			2.5 (HP)							
			- gray and tan 13 to 23 feet				1.5 (HP)							
				15	▼									
					▽									
			- with calcareous nodules 18 to 28 feet				1.75 (HP)	UC	1.25	5.7	38.9	87		
				20										
			- reddish brown and gray 23 to 28 feet				1.75 (HP)							
		28.0		25										
4			**SILT WITH SAND (ML)**, tan, medium dense				3-5-5 N=10				23.1		22-19-3	71.4
		33.0		30	▽									
			SANDY SILT (ML), tan, medium dense				6-7-8 N=15				23.1			67.3
		38.0		35										
			SILTY SAND (SM), tan, dense, with clay pockets				4-16-18 N=34							
		40.0		40										
			Boring Terminated at 40 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-20-2025

Boring Completed
03-20-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-03

Location: See Exploration Plan

Latitude: 29.4641° Longitude: -95.4326°

Model Layer	Depth (Ft.)	Graphic Log	Material Description	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1	0		**FILL - FAT CLAY (CH)**, reddish brown			1.0 (HP)							
						1.25 (HP)				38.2		81-20-61	
	5.0					3.5 (HP)	UC	2.47	4	33.1	93		
2	5		**FAT CLAY (CH)**, dark gray, medium stiff to very stiff, with sand pockets			3.25 (HP)				30.4		83-22-61	
						1.0 (HP)							
	10		- with slickensides 10 to 18 feet - gray 10 to 23 feet			1.25 (HP)	UC	0.81	5.1	40.9	78		
						1.5 (HP)							
	15												
			- with calcareous nodules 18 to 23 feet			1.75 (HP)							
	20			▽									
			- reddish brown 23 to 33 feet			1.75 (HP)				26.2		62-19-43	99.3
	25												
						2.0 (HP)							
	30			▽									
	33.0												
4			**SANDY SILT (ML)**, tan, loose			3-3-5 N=8				24.9			67.4
	35												
	38.0												
			SILTY SAND (SM), tan, medium dense			5-6-7 N=13							
	40.0												
	40		***Boring Terminated at 40 Feet***										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-20-2025

Boring Completed
03-20-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-04

Location: See Exploration Plan

Latitude: 29.4639° Longitude: -95.4329°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1			**FAT CLAY (CH)**, tan, gray, and dark gray				1.0 (HP)				31.1		80-21-59	
1			- with slickensides 2 to 4 feet				2.0 (HP)	UC	1.51	5.9	34.7	87		
1		5.0		5			2.25 (HP)				34.8		66-19-47	
2			**FAT CLAY (CH)**, dark gray, medium stiff to stiff, with sand pockets				0.75 (HP)							
2							1.25 (HP)							
2			- gray, with slickensides 10 to 23 feet	10			1.75 (HP)	UC	1.23	1.9	36.7	83		
2														
2				15			1.25 (HP)							
2														
2					▼		1.5 (HP)	UC	1.00	2.9	31.6	87	80-21-59	
2				20	▽									
2			- reddish brown 23 to 28 feet				1.75 (HP)							
2				25										
2		28.0												
3			**LEAN CLAY (CL)**, tan, medium stiff, with silt and sand seams				0.75 (HP)							
3		33.0		30										
4			**SILTY SAND (SM)**, tan, medium dense		▽		3-5-6 N=11				26.3			23.8
4				35										
4							3-10-11 N=21							
4		40.0		40										
			Boring Terminated at 40 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ While drilling
▽ After 5 minutes
▼ After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-20-2025

Boring Completed
03-20-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-05

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4643° Longitude: -95.4331° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, reddish brown, gray, and dark gray, with sand pockets				0.5 (HP)							
		- with calcareous nodules 2 to 4 feet				1.25 (HP)				28.9		68-20-48	
			5			4.25 (HP)	UC	3.54	3.1	27.0	96		
						1.5 (HP)				24.1		77-23-54	98.5
		9.0				1.5 (HP)							
2		**FAT CLAY (CH)**, dark gray, stiff to very stiff, with sand pockets - gray, with slickensides 10 to 13 feet	10			1.75 (HP)	UC	1.24	2.3	37.4	80		
		- gray and tan, with calcareous nodules 13 to 23 feet				1.5 (HP)							
			15										
						2.25 (HP)							
			20										
		- reddish brown 23 to 38 feet		▼		2.25 (HP)				30.3		67-20-47	
			25										
		- with slickensides 28 to 33 feet				2.25 (HP)	UC	1.09	1.9	29.6	92		
			30										
		- with silt seams 33 to 38 feet				2.25 (HP)							
			35	▼									
		38.0											
4		**SILTY SAND (SM)**, tan, medium dense				3-5-7 N=12				24.1			24.4
		40.0	40										
		Boring Terminated at 40 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ While drilling
▽ After 5 minutes
▼ After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-19-2025

Boring Completed
03-19-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-06

Location: See Exploration Plan

Latitude: 29.4640° Longitude: -95.4334°

Model Layer	Graphic Log	Depth (Ft.)	Description	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0.0	**FILL - FAT CLAY (CH)**, tan, with sand pockets			0.25 (HP)				36.7		70-19-51	
						1.75 (HP)	UC	1.23	4.2	36.2	85		
		5				2.0 (HP)				27.2		78-20-58	94.0
						1.25 (HP)							
						1.0 (HP)	UC	0.59	1	41.2	80		
		10				2.0 (HP)							
			- with calcareous nodules 13 to 23 feet			1.5 (HP)							
		15											
						1.25 (HP)	UC	0.10	0.5	40.2	80		
2		20											
			- reddish brown below 23 feet			2.75 (HP)							
		25											
				▼		2.5 (HP)				30.0		70-27-43	
		30		▽									
						3.0 (HP)							
		35		▽									
						2.5 (HP)							
		40	40.0										
			Boring Terminated at 40 Feet										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ While drilling
▽ After 5 minutes
▼ After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-19-2025

Boring Completed
03-19-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-07

Location: See Exploration Plan

Latitude: 29.4638° Longitude: -95.4331°

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, reddish brown, with sand pockets			0.5 (HP)							
					1.25 (HP)				35.2		77-23-54	96.3
					2.0 (HP)	UC	1.90	4.7	38.7	82		
					1.0 (HP)				19.3		63-21-42	
		8.0										
2		**FAT CLAY (CH)**, dark gray, medium stiff to stiff, with sand pockets			1.0 (HP)	UC	0.76	10.5	42.2	78		
					1.5 (HP)							
		- gray, with ferrous nodules 13 to 23 feet			2.0 (HP)							
		- with calcareous nodules 18 to 28 feet			1.5 (HP)							
		- reddish brown 23 to 28 feet			1.75 (HP)				27.7		60-19-41	
		28.0										
3		**SANDY LEAN CLAY (CL)**, tan, soft			0.5 (HP)							
		33.0										
4		**SANDY SILT (ML)**, tan, medium dense			3-5-8 N=13				25.0			67.8
		38.0										
		SILTY SAND (SM), tan, medium dense			5-11-10 N=21							
		40.0										
		Boring Terminated at 40 Feet										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
While drilling
After 5 minutes
After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-19-2025

Boring Completed
03-19-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & Whhite Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-08

Location: See Exploration Plan

Latitude: 29.4638° Longitude: -95.4333°

Model Layer	Depth (Ft.)	Material Description	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1	0	**FILL - FAT CLAY (CH)**, tan, reddish brown, and dark gray, with sand pockets	0.75 (HP)				36.9		71-18-53	
			2.0 (HP)	UC	1.59	3.2	39.9	79		
	4.0									
		FILL - LEAN CLAY (CL), tan and reddish brown, with sand pockets and calcareous nodules	2.25 (HP)				16.2		38-11-27	
	6.0									
2		**FAT CLAY (CH)**, dark gray, medium stiff to very stiff, with sand pockets	0.75 (HP)							
			0.75 (HP)							
		- gray 10 to 23 feet	1.25 (HP)							
		- with slickensides 13 to 18 feet	1.5 (HP)	UC	0.69	2.1	41.5	80		
		- with calcareous nodules 18 to 28 feet	1.25 (HP)				35.9		79-22-57	97.1
		- reddish brown below 23 feet	2.0 (HP)							
		- with slickensides 28 to 33 feet	1.75 (HP)	UC	1.36	5.8	27.1	97		
			2.75 (HP)							
			2.25 (HP)							
	40.0									
		Boring Terminated at 40 Feet								

Depth (Ft.) — Water Level Observations — Sample Type

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
ETD

Logged by
AR

Boring Started
03-19-2025

Boring Completed
03-19-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-09

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4630° Longitude: -95.4343° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, tan, with sand pockets				1.0 (HP)				32.1		77-20-57	
						1.25 (HP)							
			5			1.75 (HP)							
2		6.0 **FAT CLAY (CH)**, dark gray, medium stiff to stiff, with sand pockets				1.25 (HP)				43.7		97-25-72	
		- gray 8 to 13 feet - with calcareous and ferrous nodules below 8 feet				1.25 (HP)							
			10			1.5 (HP)							
		- tan below 13 feet				1.0 (HP)							
		15.0 ***Boring Terminated at 15 Feet***	15										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
02-21-2025

Boring Completed
02-21-2025

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-10

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4639° Longitude: -95.4340° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, tan and dark gray, with sand pockets				0.75 (HP)							
						1.5 (HP)				33.2		83-21-62	
		4.0	5			2.25 (HP)							
2		**FAT CLAY (CH)**, dark gray, medium stiff to very stiff, with sand pockets - with ferrous nodules below 6 feet				1.0 (HP)							
		- gray 8 to 13 feet - with calcareous nodules below 8 feet				1.75 (HP)				34.5		92-23-69	
			10			1.5 (HP)							
		- tan below 13 feet											
		15.0				2.0 (HP)							
		Boring Terminated at 15 Feet	15										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
02-21-2025

Boring Completed
02-21-2025

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-11

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4634° Longitude: -95.4336° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, tan and gray, with sand pockets - with calcareous nodules 0 to 4 feet - with ferrous nodules 2 to 4 feet				0.25 (HP)				72.1		82-19-63	85.1
						1.25 (HP)							
			5			3.0 (HP)							
		- with calcareous nodules 6 to 8 feet - with ferrous nodules 6 to 10 feet				3.0 (HP)				26.6		81-20-61	
						2.75 (HP)							
		10.0	10										
2		**FAT CLAY (CH)**, gray, stiff to very stiff, with calcareous and ferrous nodules				3.25 (HP)							
		15.0				1.5 (HP)							
		Boring Terminated at 15 Feet	15										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
02-21-2025

Boring Completed
02-21-2025

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-12

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4640° Longitude: -95.4317° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, tan, with sand pockets				1.0 (HP)							
						0.75 (HP)				30.9		68-19-49	
		4.0	5			0.75 (HP)							
2		**FAT CLAY (CH)**, dark gray, medium stiff to very stiff, with sand pockets - with scattered roots 4 to 6 feet - with ferrous nodules below 6 feet				2.5 (HP)							
		- gray below 8 feet				4.0 (HP)							
		- with calcareous nodules below 10 feet	10			3.5 (HP)				31.3		85-23-62	
		15.0				2.75 (HP)							
		Boring Terminated at 15 Feet	15										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
02-21-2025

Boring Completed
02-21-2025

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-13

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4653° Longitude: -95.4326° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, tan and dark gray				0.5 (HP)				32.3		69-19-50	
		- with calcareous nodules 2 to 6 feet				1.0 (HP)							
			5			0.75 (HP)							
		- tan and gray, and with ferrous nodules 4 to 6 feet 6.0											
2		**FAT CLAY (CH)**, dark gray, stiff, with sand pockets				1.5 (HP)				34.3		89-21-68	
		- with scattered root 6 to 8 feet				2.0 (HP)							
		- gray, and with ferrous nodules below 8 feet											
		- with calcareous nodules below 10 feet	10			2.0 (HP)							
		15.0				2.0 (HP)							
		Boring Terminated at 15 Feet	15										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
02-21-2025

Boring Completed
02-21-2025

Terracon
22535 N Highway 288B
Angleton, TX

Boring Log No. BH-14

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.4650° Longitude: -95.4319° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY WITH SAND (CH)**, tan				0.25 (HP)							
						1.75 (HP)				12.5		86-23-63	81.4
		- with scattered gravel 4 to 6 feet	5			4.25 (HP)							
		6.0											
2		**FAT CLAY (CH)**, dark gray, medium stiff to stiff, with sand pockets - with calcareous nodules 6 to 8 feet				1.75 (HP)							
						1.0 (HP)							
		- with ferrous nodules below 10 feet	10			2.0 (HP)							
		- gray, and with calcareous nodules below 13 feet				2.0 (HP)				32.3		87-23-64	
		15.0	15										
		Boring Terminated at 15 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
02-21-2025

Boring Completed
02-21-2025

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

Terracon
22535 N Highway 288B
Angleton, TX

General Notes

Sampling	Water Level	Field Tests
Shelby Tube Standard Penetration Test	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
Very Stiff	2.00 to 4.00	15 - 30
Hard	> 4.00	> 30

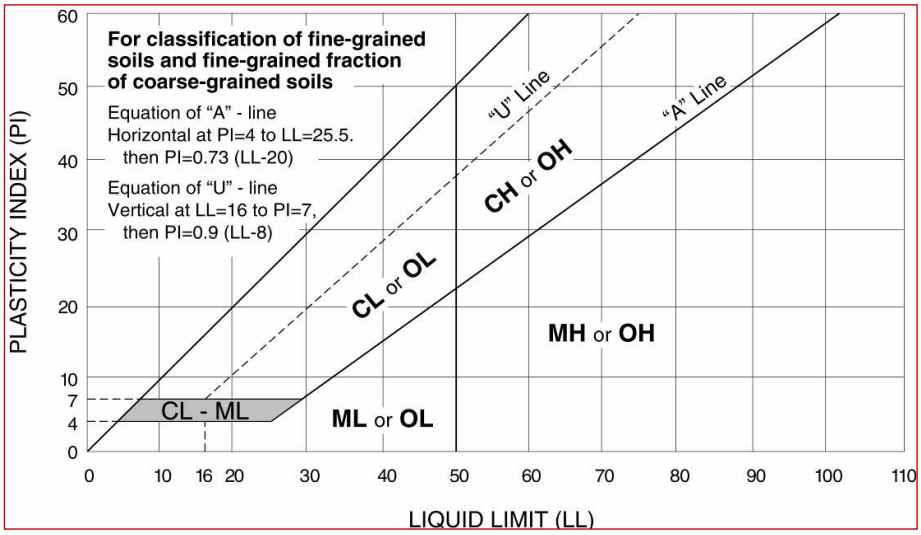
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 4 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



22535 N Highway 288-B
Angleton, TX 77515
P (979) 202-1103
Terracon.com

June 13, 2025

Alvin ISD
2200 Stapp Maxwell Drive
Alvin, Texas 77511

Attn: Mr. Bill Van Wagner
E: bvanwagner@alvinisd.net

Re: Geotechnical Engineering Letter Report
New Elementary School #23 Site
White Gold Drive and Karsten Road
Iowa Colony, Texas
Terracon Project No. AS255004.Supplement1

Dear Mr. Van Wagner:

Terracon Consultants, Inc. (Terracon) is pleased to submit this Supplemental Letter Report to provide requested recommendations in general accordance with Terracon Cost Estimate No. PAS255004.Supplement1 dated April 22, 2025, for the above-referenced project in Iowa Colony, Texas. On April 11, 2025, Stantec provided an updated site plan for the elementary school. We understand the school building was shifted about 130 feet southwest from the original location.

We understand we have been requested to provide seismic site classification, updated foundation and floor slab recommendations, LPILE parameters, modules of subgrade reaction (k) for grade supported slabs, and surveyed elevations for the soil borings. In addition, we understand we have been requested to provide conventionally-reinforced, monolithically-poured slab-on-grade recommendations for various equipment pads adjacent to the building.

Seven additional borings, designated BH-15 through BH-21, were performed with all-terrain vehicle (ATV) mounted drilling equipment and extended to depths that ranged from about 15 to 40 feet below existing grade in the proposed building and pavement areas. The field and laboratory programs were analogous to our original scope. We also utilized borings BH-01 through BH-14 from our original field program completed in February 2025.

The survey data, including Northings and Eastings and surface elevations, were obtained by Baker & Lawson, Inc. and are presented on the boring logs and are included as an attachment to this letter report.

Geotechnical Characterization

Subsurface Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this letter report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Fill – Fat Clay and Lean Clay	Reddish brown, tan, gray, and dark gray, with sand seams, calcareous and ferrous nodules, scattered roots, and slickensides
2	Fat Clay	dark gray, gray, light gray, tan, and reddish brown, medium stiff to very stiff, with silt and sand seams, calcareous and ferrous nodules, sand pockets, and slickensides
3	Sandy Lean Clay, Sandy Silty Clay and Lean Clay	reddish brown and tan, soft to stiff, with silt and sand seams
4	Clayey Sand, Silty Sand, Silt with Sand and Sandy Silt	tan, loose to very dense, with clay pockets

Groundwater Conditions

To evaluate groundwater conditions at the time of our field program, Borings BH-15 through BH-21 were advanced using dry drilling techniques to their termination depths (about 15 to 40 feet) in an effort to evaluate groundwater conditions at the time of our field program. Upon reaching groundwater, drilling was suspended for a period of about 15 minutes to allow the groundwater to rise and the groundwater levels to be recorded.

The water levels observed in the boreholes can be found on the boring logs in **Exploration Results** and are summarized below.

Summary of Groundwater Level Observations					
Boring No.	Approximate Boring Depth (feet)[1]	Approximate Depth of Dry Drilling (feet)[1]	Approximate Depth of Groundwater Below Existing Grade[2]		
			Initial / During Dry Drilling	After 5 Minutes	After 15 Minutes
BH-15	40	25	25	23	21½
BH-16	40	25	25	22½	21½
BH-17	40	30	30	28½	27
BH-18	40	25	25	23	21½
BH-19	40	30	30	27½	26½
BH-20	15	15	No groundwater observed		
BH-21	15	15			

1. Below existing grade.
2. Groundwater readings were obtained on May 19 and May 20, 2025.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is for that a **Seismic Site Classification of D** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 40 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Earthwork

Please refer to Terracon Report No. AS255004, dated April 4, 2025, for subgrade preparation recommendations, fill material and compaction requirements, grading and drainage recommendations, utility backfill considerations, and wet weather/soft subgrade considerations.

Existing Fill

Fill soils were observed in borings BH-01 through BH-21 to depths that ranged from about 2 to 10 feet below existing grade. We recommend that the fill soils be over-excavated and completely removed within the proposed building area to expose the underlying native subsurface soils. Select fill soils should be used to raise grade up in the proposed building area.

Pavement areas placed upon the deeper fill soils, such as observed in borings BH-03, BH-09, and BH-10 will also be subject to future settlement of the fill. Complete excavation, removal, and recompaction of the fill soils in the pavement areas would reduce the potential for future settlement; however, complete excavation and removal of the fill soil within the proposed pavement areas would likely not be feasible. As an alternative, the settlement potential can be reduced by reworking the upper two to three feet of fill below the pavement areas if deep fill soils are observed (or up to the underlying native soils, whichever occurs first) to reduce differential settlements, with the understanding that some settlement (which will likely result in increased maintenance of pavements) may occur.

Shallow Foundations

Design Recommendations – At Grade Slab Foundation System

We anticipate that final grade will be within about 2 feet of existing grade. If significant cuts and/or fills are planned, Terracon should be notified to review and/or modify our recommendations.

The near-surface soils observed within the area of the proposed grade supported slabs generally exhibit a medium to high expansion potential. These soils can subject the slabs to significant movements (due to shrinking and swelling) with fluctuations in their moisture content. This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of the moisture contents throughout the life of the structures. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to 5 inches. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the slabs after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the slab area. The corresponding decrease in the potential soil movements is primarily a function of the fill pad thickness and the moisture levels of the underlying clay subgrade. While the indicated preparations do not eliminate the potential for soil movement, the magnitude of such movements should be reduced to more acceptable levels. To provide uniform support to the slab and to reduce the estimated PVR to approximately one inch or less, we recommend that a minimum 60 inches of properly placed and compacted select fill material be constructed immediately beneath the slab. The select fill pad should extend a minimum of 5 feet beyond the edge of the slab area. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the structure.

The at-grade slab foundations may be designed using the following parameters provided that the subgrade is prepared as discussed above:

Item	Description
Minimum embedment depth[1]	12 inches below existing grade
Allowable bearing pressure	1,200 psf
Approximate total settlement [2]	One inch or less
Estimated differential settlement[3]	Approximately ½ of post-construction settlement
Estimated long-term modulus of subgrade reaction [4]	10 pounds per cubic inch (psi)
Allowable frictional resistance[5]	250 psf

1. To bear upon properly placed and compacted select fill soils.
2. This total post construction settlement is estimated provided that proper construction practices are implemented. The isolated thickened concrete foundation should produce a major portion of the estimated settlements during and shortly after construction.
3. Differential settlements will result from variances in subsurface conditions, loading conditions, and construction procedures, such as cleanliness of the bearing area or water seepage in the foundation excavation.
4. Based on the allowable bearing pressure provided above, we estimate a maximum square slab size of about 30 feet by 30 feet for the use in estimating the long-term modulus of subgrade reaction. This value may be used for initial design of a rigid concrete slab. Lateral loads transmitted to the isolated at-grade slab will be resisted by soil-concrete friction on the base of the slab.

Construction Considerations – Shallow Foundations

Excavations for the shallow foundations should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the excavations should

be performed using a smooth-mouthed excavation bucket or by hand labor. The excavations should be neatly excavated and properly formed. Disturbance of the bearing area of the foundations should be minimized during the excavation operations. Soft zones observed during construction should be over-excavated to a firm and undisturbed soil layer and all loose materials in the excavation bottom should be removed before placement of concrete. Water should not be allowed to accumulate at the bottom of the foundation excavations. To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavations are completed and properly cleaned. Excavations should not be left open for more than 24 hours. The bearing surface of the foundations should be evaluated immediately prior to placing concrete.

A thin seal slab (approximately 2 to 4 inches thick) should be placed at the bottom of the footing excavation to protect the bearing surface of the footing from disturbance if the footing cannot be poured within 24 hours following excavation.

Foundation Construction Monitoring

The performance of the foundation systems will be highly dependent upon the quality of construction. Thus, we recommend that subgrade preparation, fill compaction, and foundation installation be observed full time by an experienced Terracon soil technician under the direction of our Geotechnical Engineer. During foundation construction, the base of the footing excavations should be observed to evaluate the condition of the subgrade. We would be pleased to develop a plan for compaction and foundation installation observation to be incorporated in the overall quality control program.

Deep Foundations

Drilled Straight Shaft Design Parameters

Allowable skin friction and end bearing values for drilled straight shafts are presented in the following table. These design parameters were estimated based on a generalized soil profile and engineering properties of the subsurface soils observed within the depths explored at this site. The end bearing and skin friction values within the upper 6 feet of the on-site soils were neglected to account for surface effects, the presence of expansive soils, and anticipated disturbance during foundation installation. The allowable end bearing and skin friction values include a factor of safety of 2 for skin friction and a factor of safety of 3 for end bearing. The drilled straight shaft foundations should be placed to bear within native soils at a minimum depth of 15 feet below existing grade to help offset the uplift force caused by post-construction heave of expansive soils in the active zone.

Groundwater was assumed to be 20 feet below existing grade for the design parameters provided below.

Drilled Straight Shaft Design Parameters		
Depth Below Existing Grade[1] (ft)	**Allowable Side Friction[2,3] (psf)**	**Net Allowable End Bearing Pressure (psf)[4]**
0 to 6	Disregard	
6 to 13	150	1,600
13 to 20	250	2,400
20 to 25	300	3,600
25 to 33	150	2,100
33 to 40	550	3,600

1. Grade at the time of our field program.
2. The allowable side friction is based on a rectangular pressure distribution.
3. Applicable for compressive loading only. Reduce to 2/3 of values shown for uplift loading. Effective weight of shaft can be added to uplift load capacity.
4. The net allowable end bearing pressure refers to the pressure at the foundation bearing level in excess of the surrounding overburden pressure.

A minimum penetration of 2 feet into the desired bearing strata with a minimum of 2 feet of the selected bearing stratum below the bottom of the shaft is required to achieve the recommended allowable end bearing values provided in the above table. Design of shafts should also include an evaluation of the structural capacity of the foundation element which may limit the allowable capacity.

There are numerous factors which contribute to the behavior of groups subjected to axial load. Several of these factors are foundation type, size and length, spacing, overall group size, loading conditions, installation procedures and soil type and strength. We recommend a minimum spacing of three diameters, center-to-center, for shafts placed in groups beneath square or rectangular caps. However, for shafts placed in a linear pattern beneath load bearing walls, a minimum spacing of two diameters, center-to-center, would generally be acceptable. Closer spacing than three diameters in groups or two diameters in rows could result in increased group settlement and a reduction of load-carrying capacity of individual foundation elements.

Settlement of a single, isolated shaft will depend on the elastic properties of the foundation, the applied load, and the interaction of the soil and foundation. Settlement is anticipated to be primarily elastic and will occur relatively soon as load is applied. Significant consolidation settlement due to applied load is not anticipated for the allowable capacities. Our experience indicates that a single, isolated foundation loaded to about one-half of its ultimate capacity will result in settlements of less than one inch. Groups generally undergo more settlement than single, isolated foundation elements for the same applied load. Based on the above recommended spacing, we anticipate that

settlement of a group will be on the order of one inch under working loads with differential settlement between columns of approximately one-half inch.

The deep foundations will provide resistance to lateral loads through the passive earth pressure acting on the side of the foundation. A detailed lateral load analysis of the proposed straight shaft footings was beyond the scope of this project. If requested, a lateral load analysis of the proposed deep foundations can be performed by Terracon. Lateral loads should not exceed the structural capacity of the individual shaft. Refer to the **Drilled Straight Shaft Lateral Loading** section for LPILE parameters to be used in lateral load analysis of the school building foundations.

Drilled straight shaft foundations will provide resistance to structural uplift loads through the mobilization of the skin friction acting at the interface of the shaft sidewall and the adjacent soils. The allowable skin friction values provided in the previous table may be reduced to 2/3 of values shown to calculate the uplift resistance for the shafts.

Drilled Straight Shaft Lateral Loading

As requested, LPILE design parameters are presented in the following table for the school building. These design parameters were computed based on generalized soil profiles and engineering properties of the subsurface soils observed within the depths explored at this site for the proposed school building.

The following table lists input values for use in LPILE analyses. Modern versions of LPILE provide estimated default values of k_h and E_{50} based on strength and are recommended for the project. Since deflection or a service limit criterion will most likely control lateral capacity design, no safety/resistance factor is included with the parameters. Groundwater was assumed to be at a depth of 20 feet for the design parameters provided below.

Stratigraphy[1] Depth	L-Pile Soil Model	S_u (psf)[2]	ϕ[2]	γ' (pcf)[2]	ε_{50}	K_h (pci)	
						Static	Cyclic
0 to 6	Stiff Clay w/o Free Water	500	---	120	Use Default Value		
6 to 13	Stiff Clay w/o Free Water	700	---	120	Use Default Value		
13 to 20	Stiff Clay w/o Free Water	1,000	---	120	Use Default Value		
20 to 25	Stiff Clay w/o Free Water	1,200	---	58	Use Default Value		

Stratigraphy[1] Depth	L-Pile Soil Model	S_u (psf)[2]	ϕ[2]	γ' (pcf)[2]	ε_{50}	K_h (pci) Static	K_h (pci) Cyclic
25 to 33	Stiff Clay w/o Free Water	700	---	58	Use Default Value		
33 to 40	Sand/Reese	---	29	53	Use Default Value		

1. See Subsurface Profile in **Geotechnical Characterization** for more details on Stratigraphy.
2. Definition of Terms:
   S_u: Undrained shear strength
   ϕ: Internal friction angle
   γ': Effective unit weight

These parameters are based on an evaluation of a single pile. Appropriate reduction factors should be used when performing a lateral load analysis of piles in a group. These reduction factors are based on the direction of the applied lateral load as it relates to the pile group, spacing of the piles, and configuration of the piles within the group. If desired, Terracon can review a proposed foundation layout and assist with providing group reduction factors.

Drilled Straight Shaft Construction Considerations

The drilling contractor should be experienced in the subsurface conditions observed at the site, and the excavations should be performed with equipment capable of providing a relatively clean bearing area. The drilled straight shaft foundations should be installed in general accordance with the procedures presented in " Drilled Shafts: Construction Procedures and LRFD Design Methods," by Brown, D.A., Turner, J.P., and Castelli, R.J., FHA Publication No. FHWA-NHI-10-016, 2010 and "Standard Specification for the Construction of Drilled Piers", ACI Publication No. 336.1-01, 2001.

The successful completion of the drilled shafts will depend to a large extent on the suitability of the equipment and the operator's skills. The operation sequence should be scheduled so that the shaft excavations can be completed, reinforcing steel placed, and the concrete poured in a continuous, rapid, and orderly manner to minimize the time the excavations are open. Concrete should be placed as soon as practical and in all instances should be placed within the same day. Concrete should be poured with a tremie and should exhibit a six-inch slump with a ±one-inch tolerance.

Zones of sloughing soils and/or groundwater inflow will likely occur during construction, particularly in the more silty/sandy zones within the subgrade. Therefore, we recommend that provisions be incorporated into the plans and specifications to utilize slurry or casing to control sloughing and/or groundwater seepage during shaft construction.

The need for casing or slurry will depend on the depth of the drilled shaft and the groundwater conditions at the time of construction. If casing is used and seepage persists, the water accumulating in the foundation excavation should be pumped out. The condition of the bearing surface should be evaluated immediately prior to placing concrete, if casing is used in lieu of slurry. If groundwater inflow is too severe to be controlled by the use of casing and pumping or significant sloughing of the sidewalls occurs, the slurry method of construction should be utilized to complete the foundation installation.

Where casing is used, removal of the casing should be performed with extreme care and under proper supervision to minimize mixing of the surrounding soil and water with the fresh concrete. Rapid withdrawal of the casing may develop a suction that could cause the soil and water to flow into the excavation. An insufficient head of concrete in the casing during withdrawal could also allow the water to intrude into the wet concrete. Under no circumstances should loose soil be placed in the annulus between the casing and the drilled shaft sidewalls. The casing must be removed in order to utilize the skin friction values previously provided.

During slurry displacement, the foundation excavation is filled with a slurry mixture. The level of slurry should be maintained above the groundwater level to maintain a positive head in the foundation excavation. Therefore, the slurry tends to seep out of the excavation, rather than the groundwater seeping into the open excavation. The slurry must be maintained in the foundation excavation until design termination depth is achieved and should be removed only as concreting proceeds. The properties of the slurry including the density, viscosity, and pH must be carefully controlled and should be in accordance with Item 416 of Texas Department of Transportation (TXDOT) Standard Specifications for Construction of Highways, Streets, and Bridges.

Slurry left in place for long periods of time will build up on the sides of the shaft causing a reduction in skin friction.

The following procedures and equipment are recommended for installation of the drilled shafts by the Slurry Displacement Method:

- The bottom of the shaft should be cleaned as well as practical just prior to concreting to remove cuttings.
- The concrete should be placed by means of a tremie with a one-way valve to prevent slurry from entering the pipe. The tremie should extend to the bottom of the shaft to allow displacement of the slurry.
- The end of the tremie should remain several feet within the concrete mass to reduce the entrapment of slurry.
- The concrete should be relatively fluid to reduce the entrapment of slurry. We recommend that concrete with a slump of 6 to 8 inches be used.

- The upper few feet of concrete should be expunged from the shaft excavation if found to be contaminated with slurry or soil.

A surface casing may be required in addition to the slurry for shaft installation at this site if sloughing of the surficial soils occurs. Where casing is used, removal of the casing should be performed with extreme care as previously discussed in this section.

Production shaft installation should be observed by a qualified technician experienced in drilled shaft installation techniques. At a minimum, the technician should observe shaft excavation, note any unusual installation occurrences, observe slurry properties and/or casing installation and removal, observe concrete placement and generally evaluate if shaft installation is being performed in accordance with the project specifications.

Floor Slab

Planned finished grades for the proposed building were not available at the time of this report. We anticipate that the finished floor elevation of the proposed building is planned to be within about 2 feet of existing grade. If the grading is planned to be altered from what has been previously described, Terracon should be notified to review and/or modify our recommendations given in this subsection.

Due to the amount of fill observed at this site, we recommend that the fill soils be over-excavated and completely removed within the proposed building area. The exposed subgrade after over-excavation should be thoroughly proofrolled and prepared as outlined in the **Earthwork** section of the original report (including evaluation for moisture and density). Select fill soils should be used to raise grade up in the proposed building area.

The near-surface soils observed at this site generally exhibit a high expansion potential. These soils can subject the interior floor slab of the building to significant movements (due to shrinking and swelling) with fluctuations in their moisture content. This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of the moisture contents throughout the life of the building. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to approximately 5 inches. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the grade-supported floor slabs. The corresponding decrease in the potential soil movements is primarily a function of the fill pad thickness and the moisture levels of the underlying clay subgrade. While the indicated preparations do not eliminate the potential for soil movement, the magnitude of such movements should be reduced to more acceptable levels. To provide uniform support to the floor slab and to reduce the estimated PVR to approximately one inch or less, we recommend that a minimum 60 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slab. The select fill pad should extend a minimum of 5 feet beyond the edge of the building area. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the building.

Select fill should be utilized for all grade adjustments within the proposed building area. The subgrade and select fill soils should be prepared as outlined in the **Earthwork** section of the original report, which contains material and placement requirements for select fill, as well as other subgrade preparation recommendations.

The estimated modulus of subgrade reaction (k) for the grade supported slab is 75 pounds per cubic inch (pci). This value reflects the response of the subgrade under temporary, elastic conditions, and small deflections. This value does not take into account the total settlement anticipated for the foundation.

The subgrade soils for flatwork outside of the building which will be sensitive to movement should be prepared as discussed previously. This preparation will be important on surrounding sidewalks and paving immediately adjacent to the building. If these adjacent flatwork areas are not prepared as stated above for the building area, the estimated PVR for these areas could approach those indicated previously for in-situ conditions. If the soils swell in these areas, this movement could result in significant distress to the adjacent sidewalks and paving and possibly result in reversed drainage (flow of runoff toward the building) around the perimeter of the building.

Pavements

Please refer to the **Pavements** section of Terracon Report No. AS255004, dated April 4, 2025 for pavement design considerations.

We trust this supplemental letter report is responsive to your project needs. Please note that any items not specifically discussed above should be addressed as indicated in our original report. Please contact us if you have any questions or we can be of further assistance.

We appreciate the opportunity to work with you on this project and look forward t providing additional geotechnical engineering and construction materials testing services in the future.

Sincerely,
Terracon
(Texas Firm Registration No. F-3272)

Graham J. Cluck, E.I.T.
Group Manager

Rebecca C. Rice, P.E.
Geotechnical Services Manager

Attachments:

Figures
- Geomodel

Site Location and Exploration Plan
Exploration and Laboratory Results
- Boring Logs
- Survey Bore Hole Exhibit

Supporting Information
- General Notes
- United Soil Classification System

Figures

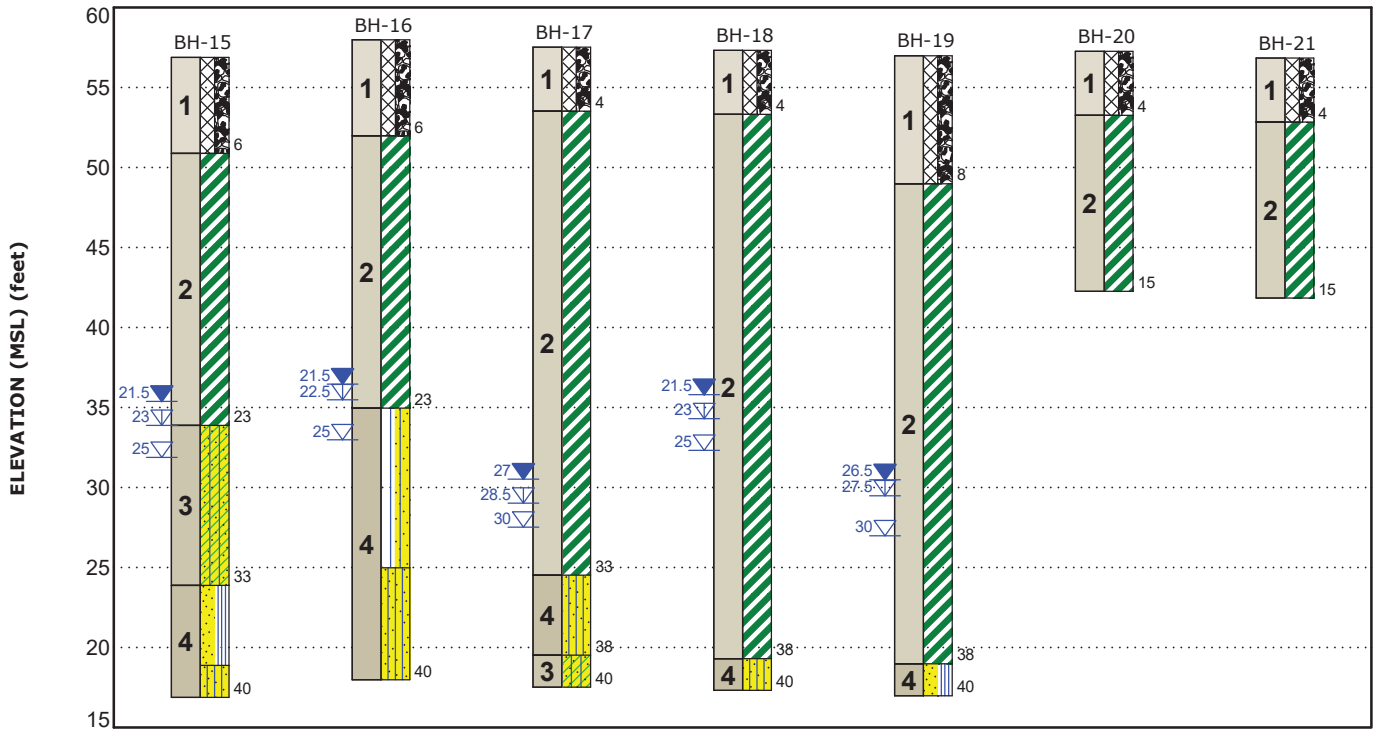
Contents:

GeoModel

New Elementary #23 Site
Karsten Blvd & White Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

Terracon
22535 N Highway 288B
Angleton, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	**Fill - Fat Clay and Lean Clay**	reddish brown, tan, gray, and dark gray, with sand seams, scattered roots, calcareous and ferrous nodules, and slickensides
2	**Fat Clay**	dark gray, gray, light gray, tan, and reddish brown, medium stiff to very stiff, with silt and sand seams, calcareous and ferrous nodules, sand pockets, and slickensides
3	**Sandy Lean Clay, Sandy Silty Clay and Lean Clay**	reddish brown and tan, soft to stiff, with silt and sand seams
4	**Clayey Sand, Silty Sand, Silt with Sand and Sandy Silt**	tan, loose to very dense, with clay pockets

Legend

- Fill
- Fat Clay
- Sandy Silty Clay
- Poorly-graded Sand with Silt
- Silty Sand
- Silt with Sand

▽ First Water Observation
▽ Second Water Observation
▼ Third Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Site Location and Exploration Plan

Contents:

Site Location
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

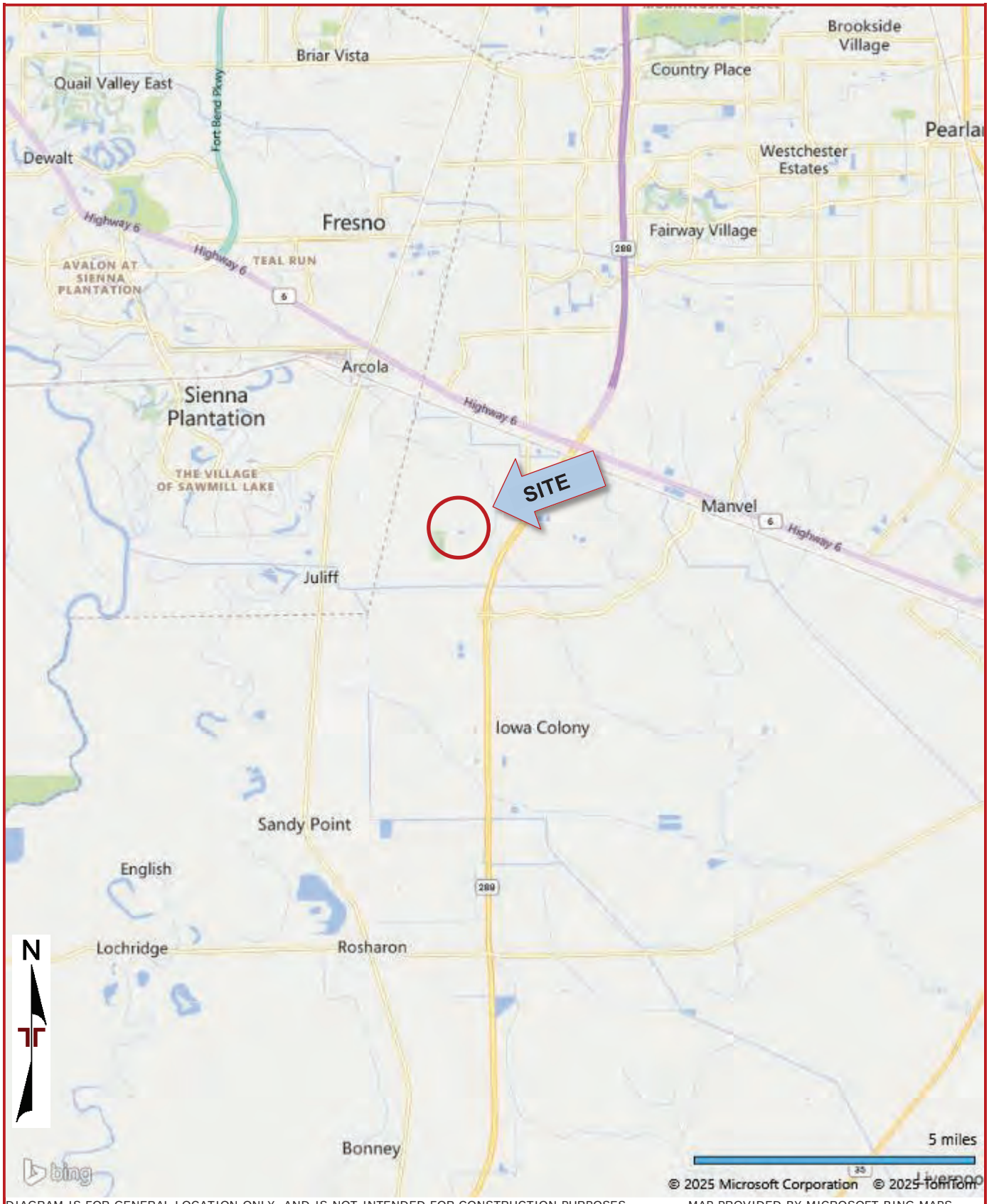
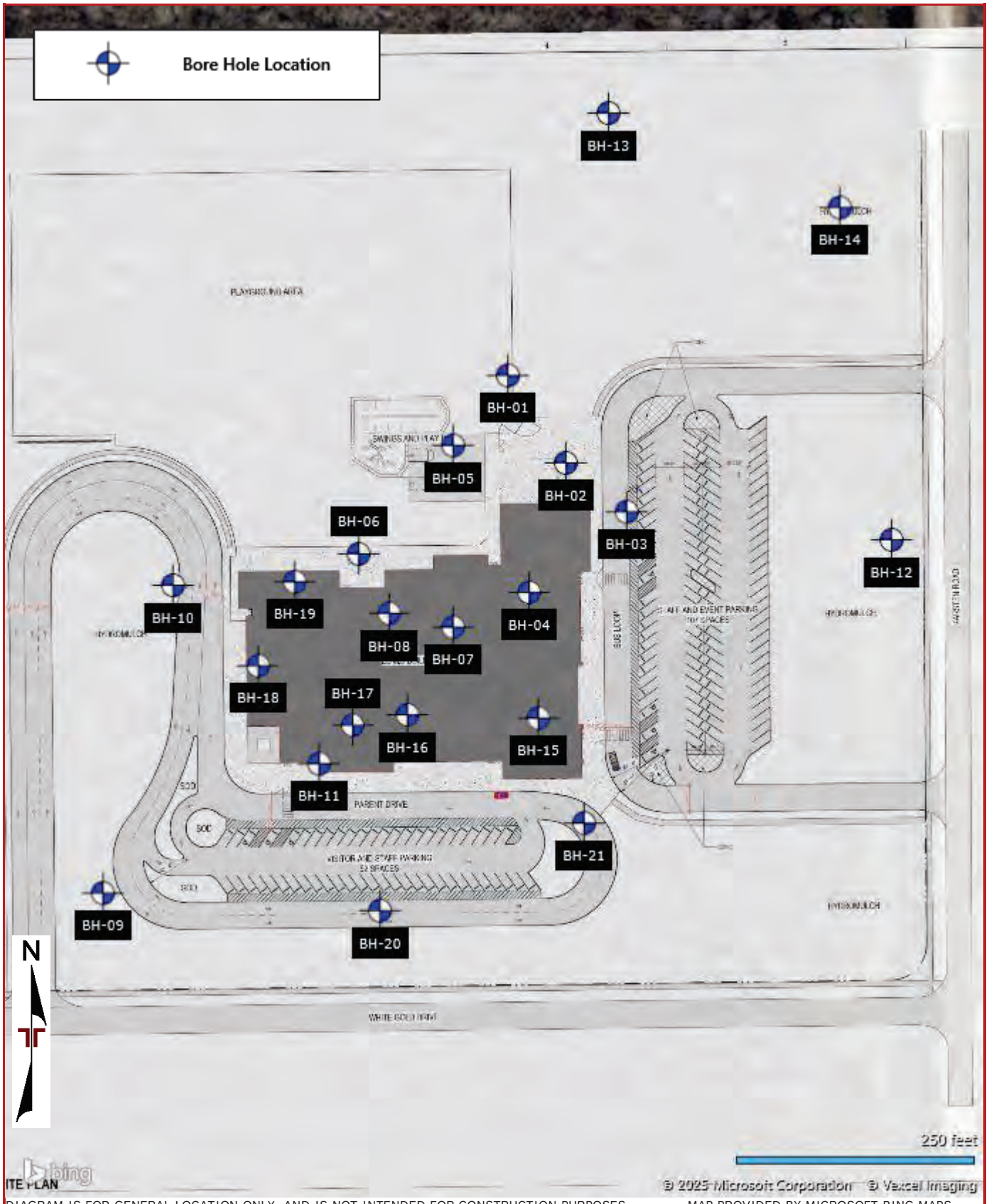


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan



ITE PLAN

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (BH-15 through BH-21)
Survey Bore Hole Exhibit

Note: All attachments are one page unless noted above.

New Elementary #23 Site
Karsten Blvd & White Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-15

Location: See Exploration Plan

Latitude: 29.4635° Longitude: -95.4328°

Depth (Ft.) Elevation: 56.88 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0			1.0 (HP)				27.8		80-20-60	
					2.25 (HP)	UC	1.57	3.9	31.7	92		
		5			1.25 (HP)				26.1		65-17-48	
					0.75 (HP)							
					1.0 (HP)							
		10			1.0 (HP)	UC	0.89	2.4	37.9	82		
2					2.25 (HP)							
		15										
					2.5 (HP)	UC	2.04	9	21.3	108		
		20										
					1-2-4 N=6				24.2		22-18-4	69.3
3		25										
					5-5-4 N=9							
		30										
4					5-8-11 N=19				24.5			10.9
		35										
					3-10-11 N=21							
		40										

FILL - FAT CLAY (CH), tan, with sand seams

- with scattered roots 2 to 4 feet
- with calcareous nodules and sand pockets 4 to 6 feet

6.0 50.88

FAT CLAY (CH), dark gray, medium stiff to very stiff

- gray 8 to 10 feet
- with ferrous nodules 8 to 18 feet
- light gray 10 to 13 feet
- with calcareous nodules 10 to 23 feet
- with slickensides 13 to 23 feet

23.0 33.88

SANDY SILTY CLAY (CL-ML), tan, medium stiff to stiff

33.0 23.88

POORLY GRADED SAND WITH SILT (SP-SM), tan, medium dense

38.0 18.88

SILTY SAND (SM), tan, medium dense

40.0 16.88

Boring Terminated at 40 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Logged by
AR

Boring Started
05-20-2025

Boring Completed
05-20-2025

Notes

Advancement Method
Dry augered to 25 feet, wet rotary thereafter

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & White Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-16

Location: See Exploration Plan

Latitude: 29.4635° Longitude: -95.4333°

Depth (Ft.) Elevation: 57.97 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0			1.25 (HP)							
					1.0 (HP)				35.2		92-28-64	
		5			2.0 (HP)	UC	1.11	5.9	32.9	87		
2					1.0 (HP)				35.1		81-26-55	
					1.25 (HP)							
		10			1.5 (HP)							
					2.25 (HP)	UC	1.18	2	27.6	95		
		15										
					2.25 (HP)							
		20	▽									
			▽									
			▽		1-2-2 N=4				25.2		22-19-3	72.5
		25										
					1-1-2 N=3							
4		30										
					4-9-12 N=21				25.3		NP	38.1
		35										
					2-6-4 N=10							
		40										

FILL - FAT CLAY (CH), tan

- tan and gray, and with sand pockets 2 to 4 feet

6.0 51.97

FAT CLAY (CH), dark gray, medium stiff to very stiff

- with ferrous nodules 8 to 18 feet

- gray 10 to 13 feet
- with calcareous nodules 10 to 23 feet

23.0 34.97

SILT WITH SAND (ML), tan, very loose to loose

33.0 24.97

SILTY SAND (SM), tan, medium dense

40.0 17.97

Boring Terminated at 40 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- ▽ While drilling
- ▽ After 5 minutes
- ▽ After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Logged by
AR

Boring Started
05-20-2025

Boring Completed
05-20-2025

Notes

Advancement Method
Dry augered to 25 feet, wet rotary thereafter

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & White Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-17

Location: See Exploration Plan
Latitude: 29.4635° Longitude: -95.4335°

Model Layer	Depth (Ft.)	Elevation: 57.52 (Ft.)	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1	0	**FILL - FAT CLAY (CH)**, tan	1.0 (HP)				18.4		76-20-56	
		- dark gray and tan 2 to 4 feet	1.25 (HP)							
	4.0	53.52								
2	5	**FAT CLAY (CH)**, dark gray, medium stiff to very stiff	1.0 (HP)				42.0		88-22-66	
		- gray 6 to 8 feet - with ferrous nodules 6 to 18 feet	1.0 (HP)							
		- light gray and gray 8 to 10 feet	1.5 (HP)	UC	0.82	2.4	38.5	82		
	10	- tan 10 to 33 feet	1.25 (HP)							
		- with calcareous nodules 13 to 18 feet	1.25 (HP)							
	15									
			2.0 (HP)							
	20									
		- with calcareous nodules 23 to 28 feet	2.0 (HP)	UC	1.46	3.3	30.3	93		
	25									
		- with sand seams 28 to 33 feet	2.25 (HP)							
	30									
	33.0	24.52								
4		**SILTY SAND (SM)**, tan, medium dense	8-10-17 N=27				24.5		NP	64.2
	35									
	38.0	19.52								
3		**SANDY SILTY CLAY (CL-ML)**, tan, stiff	1-3-6 N=9							
	40.0	17.52								
	40	***Boring Terminated at 40 Feet***								

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
While drilling
After 5 minutes
After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Logged by
AR

Boring Started
05-20-2025

Boring Completed
05-20-2025

Notes

Advancement Method
Dry augered to 30 feet, wet rotary thereafter

Abandonment Method
Boring backfilled with auger cuttings upon completion.

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-18

Location: See Exploration Plan

Latitude: 29.4637° Longitude: -95.4338°

Depth (Ft.) Elevation: 57.31 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - FAT CLAY (CH)**, tan			0.5 (HP)							
					1.75 (HP)				34.7		82-20-62	
		4.0 53.31										
2		**FAT CLAY (CH)**, dark gray, medium stiff to very stiff - with slickensides 4 to 6 feet			1.75 (HP)	UC	1.11	4.4	41.3	79		
					0.75 (HP)				41.3		90-22-68	
		- gray 8 to 10 feet - with ferrous nodules 8 to 18 feet			1.25 (HP)							
		- light gray, with calcareous nodules 10 to 13 feet			1.0 (HP)							
		- with slickensides 13 to 18 feet - tan 13 to 38 feet			1.75 (HP)	UC	0.92	2.1	31.3	91		
					2.75 (HP)							
					2.25 (HP)							
		- with silt seams 28 to 33 feet			1.5 (HP)							
		- with slickensides 33 to 38 feet			2.25 (HP)	UC	1.12	2.1	33.0	90		
		38.0 19.31										
4		**SILTY SAND (SM)**, tan, very dense			16-26-34 N=60							
		40.0 17.31										
		Boring Terminated at 40 Feet										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Logged by
AR

Boring Started
05-19-2025

Boring Completed
05-19-2025

Notes

Advancement Method
Dry augered to 25 feet, wet rotary thereafter

Abandonment Method
Boring backfilled with auger cuttings upon completion.

New Elementary #23 Site
Karsten Blvd & White Gold Dr | Iowa Colony, Texas
Terracon Project No. AS255004

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-19

Location: See Exploration Plan

Latitude: 29.4639° Longitude: -95.4336°

Depth (Ft.) Elevation: 56.98 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0			0.5 (HP)				33.8		75-20-55	
					2.0 (HP)							
		5			2.75 (HP)				31.1		77-21-56	
					1.75 (HP)							
					1.25 (HP)	UC	1.07	4.6	41.7	79		
		10			1.5 (HP)							
					1.75 (HP)							
		15										
					2.5 (HP)							
2		20										
					2.0 (HP)							
		25	▼									
			▽									
					1.0 (HP)	UC	1.23	6.4	26.9	103		
		30	▽									
					2.0 (HP)							
		35										
4					15-20-27 N=47							
		40										

FILL - FAT CLAY (CH), tan

- tan and dark gray 2 to 6 feet
- with calcareous nodules 2 to 6 feet

- tan and dark gray 6 to 8 feet

8.0 48.98

FAT CLAY (CH), dark gray, stiff to very stiff

- with slickensides 8 to 10 feet

- light gray 10 to 13 feet
- with ferrous nodules 10 to 18 feet
- with calcareous nodules 10 to 28 feet

- tan 13 to 38 feet

- with slickensides 28 to 33 feet
- with silt seams 28 to 38 feet

38.0 18.98

POORLY GRADED SAND WITH SILT (SP-SM), tan, dense

40.0 16.98

Boring Terminated at 40 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
- While drilling
- After 5 minutes
- After 15 minutes

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Logged by
AR

Boring Started
05-19-2025

Boring Completed
05-19-2025

Notes

Advancement Method
Dry augered to 30 feet, wet rotary thereafter

Abandonment Method
Boring backfilled with auger cuttings upon completion.

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-20

Location: See Exploration Plan

Latitude: 29.4630° Longitude: -95.4334°

Depth (Ft.) Elevation: 57.26 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1					1.0 (HP)				28.2		78-22-56	
					2.0 (HP)							
		5			1.0 (HP)							
					1.0 (HP)				41.9		98-25-73	
2					1.25 (HP)							
		10			1.25 (HP)							
					1.5 (HP)							
		15										

FILL - FAT CLAY (CH), tan
- with sand seams 0 to 2 feet
- tan and dark gray 2 to 4 feet

4.0 53.26

FAT CLAY (CH), dark gray, medium stiff to stiff
- with ferrous and calcareous nodules 4 to 6 feet
- gray 6 to 10 feet
- with ferrous nodules 8 to 13 feet
- light gray 10 to 13 feet
- with calcareous nodules below 10 feet
- tan below 13 feet

15.0 42.26

Boring Terminated at 15 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed during or upon completion of drilling

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Logged by
AR

Boring Started
05-20-2025

Boring Completed
05-20-2025

22535 N Highway 288B
Angleton, TX

Boring Log No. BH-21

Location: See Exploration Plan

Latitude: 29.4632° Longitude: -95.4327°

Depth (Ft.) Elevation: 56.84 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0			1.0 (HP)							
					2.25 (HP)				34.0		80-19-61	
2		5			1.25 (HP)							
					1.0 (HP)							
					1.5 (HP)				37.3		85-22-63	
		10			1.5 (HP)							
					2.0 (HP)							
		15										

FILL - FAT CLAY (CH), tan
- with sand pockets 0 to 2 feet
- tan and dark gray 2 to 4 feet

4.0 52.84

FAT CLAY (CH), dark gray, medium stiff to stiff
- with calcareous nodules 4 to 6 feet
- gray 6 to 8 feet
- with ferrous nodules 6 to 10 feet
- light gray 8 to 13 feet
- with calcareous nodules below 8 feet
- tan below 13 feet

15.0 41.84

Boring Terminated at 15 Feet

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
Groundwater not observed during or upon completion of drilling

Drill Rig
ATV

Hammer Type
Automatic

Driller
DAS

Logged by
AR

Boring Started
05-20-2025

Boring Completed
05-20-2025

Notes

Advancement Method
Dry augered to termination the depth

Abandonment Method
Boring backfilled with auger cuttings upon completion.

N

0' 125' 250'

SCALE 1" = 250'

SURVEY CONTROL POINTS				
POINT #	TYPE	NORTHING	EASTING	ELEVATION
41004	BOREHOLE–1	13,733,734.76'	3,103,352.66'	57.99'
41006	BOREHOLE–2	13,733,642.58'	3,103,417.19'	57.70'
41007	BOREHOLE–3	13,733,589.51'	3,103,489.25'	57.79'
41008	BOREHOLE–4	13,733,524.79'	3,103,394.74'	57.46'
41005	BOREHOLE–5	13,733,661.43'	3,103,328.21'	57.51'
41011	BOREHOLE–6	13,733,563.10'	3,103,208.73'	57.10'
41009	BOREHOLE–7	13,733,449.68'	3,103,314.15'	58.27'
41010	BOREHOLE–8	13,733,478.50'	3,103,240.52'	57.33'
41021	BOREHOLE–9	13,733,183.21'	3,102,952.14'	57.89'
41013	BOREHOLE–10	13,733,526.77'	3,103,032.79'	57.26'
41015	BOREHOLE–11	13,733,340.16'	3,103,179.15'	57.59'
41001	BOREHOLE–12	13,733,572.37'	3,103,754.85'	56.36'
41003	BOREHOLE–13	13,734,006.07'	3,103,451.58'	56.91'
41002	BOREHOLE–14	13,733,909.10'	3,103,700.93'	58.26'
41018	BOREHOLE–15	13,733,367.92'	3,103,407.50'	56.88'
41017	BOREHOLE–16	13,733,384.53'	3,103,267.93'	57.97'
41016	BOREHOLE–17	13,733,364.28'	3,103,198.93'	57.52'
41014	BOREHOLE–18	13,733,422.30'	3,103,113.01'	57.31'
41012	BOREHOLE–19	13,733,513.73'	3,103,145.02'	56.98'
41020	BOREHOLE–20	13,733,180.10'	3,103,244.10'	57.26'
41019	BOREHOLE–21	13,733,277.24'	3,103,454.19'	56.84'

BOREHOLE EXHIBIT

ELEVATIONS BASED ON NAVD88
REFERENCE BENCHMARK: NGS MONUMENT: TXAG
REF MON 1 (PID: DR8248), PUBLISHED ELEVATION:
32.0 FEET.

I, DARREL HEIDRICH, DO HEREBY CERTIFY THAT THIS SURVEY WAS MADE ON THE GROUND, UNDER MY SUPERVISION AND CORRECTLY REPRESENTS THE FACTS AS FOUND, SURVEYED ON MAY 21, 2025.

5/22/2025

DARREL HEIDRICH
REGISTERED PROFESSIONAL LAND SURVEYOR
LAND SURVEYOR NO. 5378

STATE OF TEXAS
REGISTERED
DARREL HEIDRICH
5378
PROFESSIONAL
LAND SURVEYOR

BAKER & LAWSON, INC.
ENGINEERS▪PLANNERS▪SURVEYORS

Baker & Lawson Inc.
4005 Technology Dr., Suite 1530
Angleton, TX 77515
Phone # 979-849-6681
www.bakerlawson.com
Licensed Surveying Firm No. 10052500

DRAWING NO.: 16372 SURVEY BASE		DRAWN BY: AD	CKED BY: AH
JOB NO.: 16372	SCALE: 1" = 250'	DATE: 5/22/2025	REV. NO. 0

\\BJ-SRV01\JOBS\16000S\16300\16372\ENGINEERING-SURVEY\SURVEY BASE\16372 SURVEY BASE.DWG PLOT DATE:5/22/2025 Dheidrich

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above.

Terracon
22535 N Highway 288B
Angleton, TX

General Notes

Sampling	Water Level	Field Tests
Shelby Tube Standard Penetration Test	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	5 - 8
Stiff	1.00 to 2.00	9 - 15
Very Stiff	2.00 to 4.00	16 - 30
Hard	> 4.00	> 30

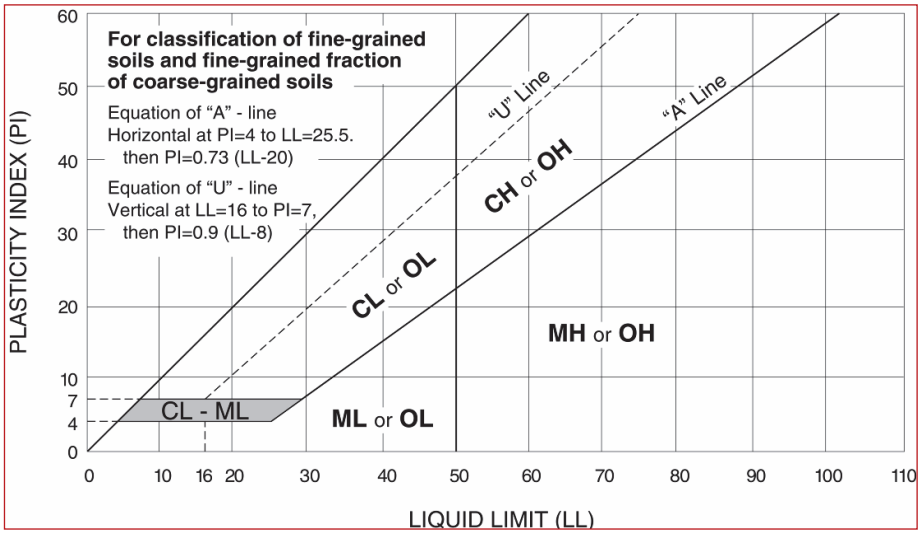
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



SECTION 00 41 00 - PROPOSAL FORM (BASE PROPOSAL & UNIT PRICES)

PROJECT: **ELEMENTARY SCHOOL #23**

PLACE: **ALVIN INDEPENDENT SCHOOL DISTRICT SUPPORT SERVICES CENTER**
2200 STAPP MAXWELL – BUILDING A
ALVIN, TEXAS 77511

DATE: **TUESDAY, SEPTEMBER 16, 2025**

TIME: **2:00 PM**

TO: **THE BOARD OF TRUSTEES, ALVIN INDEPENDENT SCHOOL DISTRICT**

FROM: _____
Company

Pursuant to and in compliance with the Invitation to Proposers and the proposed Contract Documents dated **AUGUST 18, 2025**, prepared by Stantec Architecture Inc., relating to the above referenced Project, the undersigned, hereby proposes and agrees to fully perform the work within the time stated and in strict accordance with the proposed Contract Documents, and addenda thereto, for the following sum of money:

BASE PROPOSAL

All labor, materials, services, and equipment necessary for completion of the Work shown on the drawings and in the specifications except the work indicated by the Alternates.

_____
DOLLARS

($_____)

BASE PROPOSAL UNIT PRICES

Refer to Section 01 22 00

A. Unit Price No. 1 – Additional Structural Steel:

1. Structural Steel $_____ Per TON

B. Unit Price No. 2 – Site Fill Haul Off:

1. Dirt Haul Off: $_____ Per 1,000 cubic yards

C. Unit Price No. 3 – Additional Site Fill:

1. Site Fill imported: $_____ Per 1,000 cubic yards

D. Unit Price No. 4 – Additional Duplex Outlet and Wiring:

1. Metal Stud pre-wall enclosure: $_____ Lump Sum
2. Metal Stud post-wall enclosure: $_____ Lump Sum
3. CMU pre-wall enclosure: $_____ Lump Sum
4. CMU Stud post-wall enclosure: $_____ Lump Sum

E. Unit Price No. 5 – Additional Data (2D) Outlets and Wiring:

1. Metal Stud pre-wall enclosure: $_____ Lump Sum
2. Metal Stud post-wall enclosure: $_____ Lump Sum
3. CMU pre-wall enclosure: $_____ Lump Sum
4. CMU Stud post-wall enclosure: $_____ Lump Sum

F. Unit Price No. 6 – Door Hardware:

1. HW Set (Typical Classroom): $_____ Lump Sum
2. HW Set (Typical Office): $_____ Lump Sum

G. Unit Price No. 7 – Additional Concrete Placement:

1. Grade Beams: $_____ Per Cubic Yard
2. Slab on Grade: $_____ Per Cubic Yard
3. Slab on Metal Deck: $_____ Per Cubic Yard

H. Unit Price No. 8 – Additional Reinforcing Steel:

1. Reinforcing Steel: $_____ Per Pound (lb)

I. Unit Price No. 9 – Additional Metal Deck:

1. Metal Deck for floor slab: $_____ Per Square Foot (sf)
2. Roof Metal Deck (non-acoustical): $_____ Per Square Foot (sf)

BASE PROPOSAL ALTERNATES

Refer to Section 00 41 10

CONTRACT EXECUTION - If awarded this Contract the undersigned shall execute a satisfactory Construction Contract, Performance Bond, Labor and Material Payment Bond and proof of insurance coverage, with the Owner for the entire Work as per the Contract Documents within 10 calendar days after notice of award. It is agreed that this Proposal is subjected to the Owner's acceptance for a period of 30 calendar days from the receipt of Proposals.

Enclosed is a Certified Check or Bid Bond in the amount of

$_____, in compliance with the specification requirements. (5% of highest amount proposed).

The above Check or Bid Bond is to become the property of the Owner in the event the Construction Contract (when offered by the Owner) and the bonds and proof of insurance coverage are not executed within the time set forth above.

EXTRA WORK

The undersigned agrees that should any change in the work or extra work be ordered, the allowance for overhead and profit combined shall be as scheduled below, but in no case shall it exceed 15%. The following applicable percentages shall be added to the extra work cost as defined by Article 7 of the

General Conditions.

Allowance to the Contractor for overhead and profit for extra work provided by his own forces: 10%.

Allowance to Subcontractors and Sub-subcontractors for overhead and profit for extra work: Not to exceed a total of 10% of the amount of the change.
Allowance to the Contractor for overhead and profit for extra work provided by Subcontractors and Sub-subcontractors and supervised by the Contractor 5%.

The General Contractor shall not be allowed to charge the Owner for "extended overhead" charges relating to change orders or weather delays.

The undersigned agrees to the following:

To furnish all labor and materials as shown and specified.

To substantially complete the base proposal (and any Alternates selected) by the date specified in Section 01 10 00 - Summary of Work.

The full amount of all allowances as specified in the General Requirements, Division 1, of the Specifications, is included in the Base Proposal price shown.

Receipt is acknowledged of the following issued Addenda:

No._____ Dated_____

No._____ Dated_____

No._____ Dated_____

No._____ Dated_____

By execution and submission of this Proposal, the Proposer attests and affirms that he and his subcontractors are skilled and experienced in the use of plans, specifications, addenda and related bid documents, and that he has carefully reviewed the plans, specifications, addenda and related proposal documents for this project and has found them to be sufficient for proposal and construction purposes. Further, he has carefully examined the soils reports and the site of the work, and - through his own personal observations - has satisfied himself as to the nature, location and requirements of the work; the character, quality and quantity of materials required; the difficulties likely to be encountered; the other items and/or conditions which may affect the satisfactory performance of the work. He has based his proposal solely on these documents - and personal observations - and has not relied in any way on any explanation or interpretation - oral or written - from any source other than those written and issued by the Architect/Engineer.

Representations: by execution and submission of this Proposal, the Proposer hereby represents and warrants to the Owner as follows:

The Proposer has read and understands the Proposal Documents and the Contract Documents and the Proposal is made in accordance with the Proposal Documents.

By submitting this Proposal, each Proposer agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees arising out of or in connection with the administration, evaluation, or recommendation of any Proposal; waiver of any requirements under the

Proposal Documents, or the Contract Documents; and award of the Contract.

Proposer agrees that the Owner has the right to accept or reject any or all Proposals and to waive all informalities.

Respectfully submitted,

By:_____
Signature

_____
Title

_____
Company

_____
Address

_____
City, State, Zip Code

_____
Telephone Number

_____
Email Address

(Seal - if Proposer is a corporation)

END OF DOCUMENT

SECTION 00 41 10 - PROPOSAL FORM (ALTERNATES PROPOSALS)

PROJECT: **ELEMENTARY SCHOOL #23**

PLACE: **ALVIN INDEPENDENT SCHOOL DISTRICT SUPPORT SERVICES CENTER**
2200 STAPP MAXWELL – BUILDING A
ALVIN, TEXAS 77511

DATE: **TUESDAY, SEPTEMBER 16, 2025**

TIME: **3:00 PM**

TO: **THE BOARD OF TRUSTEES, ALVIN INDEPENDENT SCHOOL DISTRICT**

FROM: _____
Company

Pursuant to and in compliance with the Invitation to Proposers and the proposed Contract Documents dated **AUGUST 18, 2025**, prepared by Stantec Architecture Inc., relating to the above referenced Project, the undersigned, hereby proposes and agrees to fully perform the work within the time stated and in strict accordance with the proposed Contract Documents, and addenda thereto, for the following sum of money:

SUBCONTRACTOR SELECTIONS

Pursuant to Requirements outlined in Section 00 23 13, Selection Criteria, the following are subcontractors performing major portions of the Work as indicated:

Mechanical_____

Building Automation Controls_____

Electrical_____

Plumbing_____

Fire Alarm Installer_____

Data Installer_____

Food Service Supplier/Installer_____

Glazing Supplier/Installer_____

ALTERNATES

The following are alternates to the Base Proposal: It is understood that if no figure is listed for an Alternate, that the Alternate may be accepted and there shall be **no change** in the Base Proposal amount indicated above. Check (add) or (deduct) as required for each alternate. Refer to Division 1 Section "Alternates" for complete description of the alternates.

Alternate No. 1
Flooring: Corridors to be Epoxy Terrazzo in lieu of VET.

Check the box: ☐ Add ☐ Deduct

Dollars Written:
Numerically written: $

Alternate No. 2
Not Used

Check the box: ☐ Add ☐ Deduct

Dollars Written:
Numerically written: $

Alternate No. 3A
Lighting Package by Putterman Scharck

Check the box: ☐ Add ☐ Deduct

Dollars Written:
Numerically written: $

Alternate No. 3B
Lighting Package by CW Lighting

Check the box: ☐ Add ☐ Deduct

Dollars Written:
Numerically written: $

Alternate No. 3C
Lighting Package by Lighting Associates

Check the box: ☐ Add ☐ Deduct

Dollars Written:
Numerically written: $

Alternate No. 4
Base Bid Adjustment (if needed)

Check the box: ☐ Add ☐ Deduct

Dollars Written:
Numerically written: $

By execution and submission of this Proposal, the Proposer attests and affirms that he and his subcontractors are skilled and experienced in the use of plans, specifications, addenda and related Bid Documents, and that he has carefully reviewed the plans, specifications, addenda and related Proposal Documents for this Project and has found them to be sufficient for Proposal and construction purposes. Further, he has carefully examined the geotechnical report(s) and the site of the Work, and through his own personal observations has satisfied himself as to the nature, location and requirements of the Work; the character, quality and quantity of materials required; the difficulties likely to be encountered; and other items and/or conditions which may affect the satisfactory performance of the Work. He has based his Proposal solely on these documents and personal observations and has not relied in any way on any explanation or interpretation - oral or written - from any source other than those written and issued by the Architect/Engineer.

Representations: by execution and submission of this Proposal, the Proposer hereby represents and warrants to the Owner as follows:

The Proposer has read and understands the Proposal Documents and the Contract Documents, and the Proposal is made in accordance with the Proposal Documents.

By submitting this Proposal each Proposer agrees to waive any claim it has or may have against the Owner, the Architect/Engineer, and their respective employees arising out of or in connection with the administration, evaluation, or recommendation of any Proposal; waiver of any requirements under the Proposal Documents, or the Contract Documents; and award of the Contract.

Proposer agrees that the Owner has the right to accept or reject any or all Proposals and to waive all informalities.

Respectfully submitted,

By:_____
Signature

_____
Title

_____
Company

_____
Address

_____
City, State, Zip Code

_____
Telephone Number

_____
Email Address

(Seal - if Proposer is a corporation)

END OF DOCUMENT

SECTION 00 43 13 - PROPOSAL SECURITY

1.1 SUPPLEMENTS TO PROPOSAL FORMS

A. Each proposal shall be accompanied by Proposal Security in the amount of 5% of the largest possible total of the Proposal submitted. The Proposal Security shall be by certified check or Bid Bond. The Bid Bond shall be executed by the Proposer as principal. The Bid Bond form and security company are subject to approval by the Owner and the surety shall comply with requirements noted in Article 11 of the Supplementary General Conditions.

B. The Proposal security shall be returned to all except the three lowest Proposers within three days after opening of the proposals. The remaining Proposal securities shall be returned promptly after the Owner and the accepted Proposer have executed the Contract, or, if no award has been made within thirty days after the date of the opening of Proposals, upon demand of the Proposer any-time thereafter so long as he has not been notified of the acceptance of his Proposal.

C. The successful Proposer, upon his failure or refusal to execute and deliver the contract, insurance and bonds required within 10 days after he has received notice of the acceptance of his proposal, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his proposal.

D. All Proposers shall submit the following with their Proposal;

    a. “Proposal Evaluation Waiver,” “Felony Conviction Notification,” “Conflict of Interest Questionnaire,” and “Certification of Criminal History Record Information.” Failure to submit such forms shall subject the proposal to be rejected as non-conforming.

E. The Proposal shall be manually signed by a person with legal authority to bind the firm to the Contract.

F. If written confirmation of a modified or withdrawn bid is not received within two days from the closing time, no consideration shall be given to the modification or withdrawal.

END OF SECTION

SECTION 00 50 00 – CONSTRUCTION CONTRACT AND CONDITIONS

1.0. CONSTRUCTION CONTRACT AGREEMENT

A. The Agreement shall be executed on AIA Document A101 “Standard Form of Agreement between Owner and Contractor”, 2017 edition. A sample of this form is available from the Architect for inspection.

2.0 CONDITIONS OF THE CONTRACT

A. The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, is hereby specifically made a part of the Contract Documents - whether attached hereto or not - shall apply to the Contractor and all Subcontractors, except as may be modified by the Project Supplementary Conditions.

B. Supplementary Conditions:
The Supplementary Conditions contain modifications to the General Conditions of the Contract for Construction, AIA Document A201. Where any part of that document is modified by Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect. Refer to Section 00 73 00 for the Supplementary Conditions.

3.0 AVAILABILITY

A. The standard General Conditions document may be obtained from:
1. the Houston Chapter of the American Institute of Architects, 315 Capitol, Suite 120, Houston, Texas 77002; (713) 520-0155.
2. Copies are also normally available for purchase from the Project printing company.

B. Failure to obtain and examine these documents in no way relieves the Contractor, Subcontractors, Sub-subcontractors, and material suppliers of responsibilities incorporated in the Agreement.

END OF DOCUMENT

SECTION 00 60 00 - BONDS AND CERTIFICATES

1.1 GENERAL

A. The Contractor shall furnish the following Bonds and Certificates to be delivered simultaneously with the executed contract:
   1. Performance Bond
   2. Payment Bond
   3. Certificates of Insurance - Provide on AIA Document G715 (1991 Edition)

1.2 CONTRACT SECURITY

A. Performance and Payment Bonds shall be required for all work where the Contract exceeds $25,000.00. After award of contracts by Owner, the successful Proposer, at Proposer's expense, must deliver to the Owner an executed Performance and Payment Bond in an amount of 100% of the accepted proposal as security for the faithful performance of the Contract and payment of all persons performing labor and furnishing materials in connection with this Contract.

B. Bonding Company must be licensed, listed, and approved in the State of Texas (State Board of Insurance).

C. Bonding Company shall provide such other information as necessary to document net worth, stability, total bonding capacity, and projects under coverage, etc., with adequate financial capacity for this Project. If the Contract sum exceeds the underwriting limitation of the Surety on the most recent list of acceptable sureties, the Contractor shall provide the Owner with evidence that the excess is protected by re-insurance or co-insurance in a form and amount acceptable to the Owner.

D. Such bonds shall meet the requirements of Chapter 2253 of the Texas Government Code.

E. Costs of the above stated bonds and insurance are to be included in the proposal.

F. Attorneys-in-Fact who sign bonds shall file with each bond a certified and effective dated copy of their Power of Attorney.

G. The Performance Bond shall guarantee the repair and maintenance of all defects due to faulty materials and workmanship that appear within one (1) year from date of substantial completion.

END OF SECTION

ALVIN ISD SUPPLEMENTARY CONDITIONS TO THE AIA DOCUMENT A201-2017 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201, Sixteenth Edition, 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. As appropriate, for purposes of this Request for Proposal, the term "Bid" shall mean "Proposal" and the term "Bidder" shall mean "Offeror", wherever they appear in the Construction Documents. The term "Contractor" shall include a Construction Manager-at-Risk.

ARTICLE 1 -- GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENT

Delete Section 1.1.1 in its entirety and substitute the following:

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

To the extent any provision in the Supplementary Conditions to these AIA Document A201-2017 General Conditions, issued by Owner, conflicts with any provision in the Supplementary Conditions issued by the Architect; the Supplementary Conditions to these AIA Document A201-2017 General Conditions issued by Owner shall control.

1.1.3 THE WORK

Add the following sentence at the end of this section:

It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following Sections:

1.2.1.2 Precedence of the Contract Documents: The most recently issued Document takes precedence over previous issues of the same Document. The order of precedence is as follows with the highest authority listed as"1".

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.
.2 The Agreement. (AIA Document A101-2017)
.3 The Supplementary Conditions
.4 The General Conditions of the Contract for Construction
.5 Addenda, with those of later date having precedence over those of earlier date
.6 Drawings and Specifications

Should these Documents disagree in themselves, the Architect and Owner will select the appropriate method for performing the Work, to facilitate avoiding increases in the Contract cost.

1.2.1.3 Relation of Specifications and Drawings: To be equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of Work indicated. In the event of the above mentioned disagreements, the resolution shall be determined by the Architect and Owner.

1.6 NOTICE

Delete the text of Section 1.6.1 in its entirety and substitute the following:

1.6.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer at the corporation for which is was intended, or if delivered at or sent by certified mail, or by registered or certified mail, or by courier service providing proof of delivery, to the last business address known to the party giving notice, or if delivered by facsimile or other electronic communications to the offices of the person or corporation for which it was intended. For facsimiles or other electronic communications received after 5:00 p.m. on a business day, or on a weekend or legal holiday on which the recipient's offices are closed, notice shall be deemed to have been duly served on the next business day.

Delete the text of Section 1.6.2 in its entirety.

Add Section 1.9 as follows:

1.9 MISCELLANEOUS OTHER DEFINITIONS

1.9.1 ADDENDA, ADDENDUM

Documents issued by the Architect prior to execution of the Owner Contractor Agreement for this Project that modify or clarify the Proposal Documents. All addenda become a part of the Contract Documents.

1.9.2 ALTERNATE PROPOSAL(S)

A separate amount stated on a separate Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

1.9.3 APPROVED, APPROVED EQUIVALENT, APPROVED EQUAL, OR EQUAL

The terms Approved, Approved Equivalent, Approved Equal, and Or Equal, relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.4.2, Substitution of Products and Systems, for procedures which must be followed after award of contract. The substitution procedure process to be followed prior to receipt of proposals is described in the Instructions to Bidders.

1.9.4 BASE PROPOSAL

The Contractor's proposal for the Work, not including any Alternates.

1.9.5 CONTRACT TIME

The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized adjustments as enumerated in the Contract Documents.

1.9.6 DATE OF AGREEMENT

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted in the first page of the Agreement between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of Work.

1.9.7 DATE OF COMMENCEMENT OF THE WORK

The date of a written Notice to Proceed to the Contractor for a given portion of the Work. This date constitutes day zero (0) of the stated Contract Time. The Notice to Proceed will be issued after the District has received and validated the Contractor's Payment Bond, Performance Bond and Insurance.

1.9.8 DATE OF FINAL COMPLETION

The end of construction. See AIA Document A201, Section 9.10.

1.9.9 DAY

The following days are referenced in the documents:

.1 Calendar Days. Extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.

.2 Holidays: The days officially recognized by the construction industry in this area as a holiday; normally limited to the observance days of New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the day after and Christmas Day.

.3 Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days, and those days, if approved, will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4).

.4 No extensions of the Contract Time will be granted due to inclement weather, except as provided in Section 8.3.1.

1.9.10 NOTICE TO PROCEED

A notice that may be given by the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

1.9.11 PROVIDE

Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

1.9.12 PUNCH LIST

A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. See AIA Document A201, Section 9.8.

1.9.13 UNIT PRICES

A cost for a unit of work as described in the Contract Documents. The Owner may add or deduct Unit Price work at the amounts stated on the Proposal Form and such amounts shall not be subject to additional mark up by the Contractor or his subcontractors."

ARTICLE 2 – OWNER

2.1 GENERAL

Delete the text of Section 2.1.1 in its entirety and substitute the following:

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. All parties understand that only the Board of Trustees for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the Board's approval under current policy of the Board of Trustees for the Owner, including, but not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.

Delete the text of Section 2.1.2 in its entirely.

2.2 EVIDENCE OF THE OWNER'S FINANCIAL ARRANGEMENTS

After the first sentence of Section 2.2.1, delete the remainder of Section 2.2.1 in its entirety. Delete

Sections 2.2.2 and 2.2.3 in their entirety.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete Section 2.3.6 in its entirety and replace it with the following:

2.3.6 The Contractor will be furnished free of charge 25 copies of the Drawings and 25 copies of the Project Manual. These copies may have been used during the Bid/Proposal process and it is the Contractor's responsibility to determine their completeness and to request replacement of any missing portions. Additional new copies will be

furnished at the cost of reproduction, postage, and handling.

2.5 OWNER'S RIGHT TO CARRY OUT THE WORK

Delete the text of Section 2.5. in its entirety and substitute the following:

If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents and fails, after receipt of written notice from the Owner, to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within thirty (30) days of receipt of written notice from the Owner therefor.

Add Section 2.6 as follows:

2.6 OWNER'S LACK OF LIABILITY TO THIRD PARTY

2.6.1 The Owner is not responsible for the acts and/or omissions of, or contractually involved with, any subcontractors, suppliers of labor or materials, and/or their respective employees or agents or any other third-party claimants. Such claimants shall not constitute third party beneficiaries under this contract. The Contractor and/or his Surety solely shall deal with, take responsibility for, and be liable to such parties under this Contract. Contractor will indemnify and defend the Owner from any legal actions against Owner for unpaid bills of subcontractors.

Add Section 2.7 as follows:

2.7 OWNER'S RIGHT TO OCCUPY THE PROJECT

2.7.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time for completing the entire work or such portions may not yet have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents. If the Contractor determines that said occupancy may cause a delay to the completion of the project, he shall notify the Owner in writing immediately.

2.7.2 Refer to Article 11 Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

2.7.3 If Contractor has not completed the obligations of the Contract Documents by the dates established by subsequent Amendments to the Agreement Between Owner and Construction Manager, the Owner shall have the right to occupy or use the entire project.

ARTICLE 3 -- CONTRACTOR

3.1 GENERAL

Add Section 3.1.4 as follows:

3.1.4 The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining that all of his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Delete the last sentence of Section 3.2.4 in its entirety and substitute the following:

If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities provided

such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

Add Sections 3.2.5, 3.2.6 and 3.2.7 as follows:

3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work of all major subcontractors, to allow the subcontractor to demonstrate his understanding of the documents to the Architect and to allow the subcontractor to ask for any interpretation he may require.

3.2.6 If, in the opinion of the Architect, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Sections 3.2.5, 3.2.6 and 3.7 before additional services are performed.

3.2.7 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor his Warranty, he shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary changes, including substitutions of materials, shall be accomplished by appropriate Modification.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Delete the last sentence of Section 3.3.1 in its entirety and substitute the following:

If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

Add Sections 3.3.4 and 3.3.5 as follows:

3.3.4 The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

3.3.5 Contractor shall bear sole responsibilities for design and execution of acceptable trenching and shoring procedures, in accordance with Texas Government Code, Section 2166.303 and Texas Health and Safety Code, Subchapter C, Sections 756.021, et seq. On trench excavations in excess of 5 feet in depth, Contractor shall pay a qualified engineer, experienced in the engineering design and preparation of drawings and specifications for compliance with state requirements for trenching and shoring, to prepare and professionally seal detailed drawings and specifications directing Contractor in the safe execution of trenching and shoring.

3.3.6 Any time that the Contractors' employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for or on behalf of the Contractor or any of its subcontractors are on site, the work shall be supervised by a qualified employee of the Contractor.

3.4 LABOR AND MATERIALS

Delete Section 3.4.2 in its entirety and replace it with the following:

3.4.2 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

.1 If, after award of contract, the Contractor of one of his Subcontractors, or Suppliers determines that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed

substantiation for his position. Any changes deemed necessary by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accompanied by appropriate Modification.

.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.

.3 Requests for substitution, received by the Architect later than forty five (45) days after “Notice to Proceed” or “Date of Commencement of the Work” (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.

.4 By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor

.1 Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;

.2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

.3 Certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect’s redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

.5 Substitution requests shall be submitted on the forms included herein and in accordance with the process established in specification referring to Product Options and Substitutions.

Add the following Sections after Section 3.4.3

3.4.3.1 State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.

.2 State law prohibits weapons or firearms on school property.

.3 There shall be zero tolerance for fraternization with students, teachers and any other school district personnel, Contractor will immediately remove any employee that violates this provision from the project.

.4 No glass bottles shall be brought on the construction site or Owner’s property by any construction personnel.

3.5 WARRANTY

Delete the text of Section 3.5.1 in its entirety and substitute the following:

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

Add Sections 3.5.3, 3.5.4 and 3.5.5 as follows:

3.5.3 In the event of failure in the Work, including a specified product, whether during construction, or the correction period (which shall be one (1) year from the Date of Substantial Completion, except where a longer period as specified), the Contractor shall take prompt and appropriate measures to assure correction or replacement of the defective Work or any portion thereof, including manufactured products, whether notified by the Owner or the Architect. Upon correction of warranty items, the Contractor shall provide the Owner and Architect with written notification of said correction. This obligation shall survive acceptance of the Work under the Construction Contract.

3.5.4 The Contractual Correction Period for this Project is one (1) year from the date of Substantial Completion, except for any extended warranties as specified within the Contract Documents. Items of Work not completed until after the deadline for Substantial Completions shall have their warranties (general and any extended warranty periods)

extended by the period of time between the deadline for Substantial Completion and the actual completion of the Work. Such warranties shall be submitted to the Owner in writing, documenting such time extensions. This correction period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the Work.

3.5.5 The Contractor shall accompany the Owner and Architect for a complete reinspection of the Project approximately eleven (11) months after the Date of Substantial Completion and shall promptly complete any observed or reported deficiencies in the Work, including any uncompleted Punch List items or outstanding and incomplete warranty items. The contractor shall provide written notification to the Owner and Architect when said Punch List items and/or additional deficiencies observed have been corrected. This obligation shall survive acceptance of the Work under the Construction Contract.

3.6 TAXES

Delete Section 3.6 in its entirety and substitute the following:

The Owner qualifies for exemption from State and Local Sales and Use Taxes pursuant to the provision of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act. Taxes normally levied on the purchase, rental and lease of materials, supplies and equipment used or consumed in performance of the Contract may be exempted by issuing to suppliers an exemption certificate in lieu of tax. Exemption certificates comply with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate

issued in lieu of tax shall be subject to State Comptroller of Public Accounts Ruling No. 95-0.09, as amended. Failure by the Contractor or Subcontractors to take advantage of the Owner's exemption and to obtain such exemption certificate shall make him responsible for paying taxes incurred on materials furnished on the Project without additional cost to or reimbursement by the Owner.

3.7 PERMITS, FEES, NOTICES AND COMPLIANCES WITH LAWS

After Section 3.7.1, add the following Sections:

3.7.1.1 The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar utility connection charges.

.2 The Contractor shall pay directly all temporary utility charges (excluding permanent power), utility district/company inspection fees, temporary tap charges, and temporary water meter charges and any other similar fees assessed by jurisdictional authority having control over this Project. The Contractor shall secure and pay for all governing authorities' permit fees.

.3 Fees payable to the Texas Department of Licensing and Regulation (TDLR) for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner and the Architect will submit the documents to the TDLR for review and approval.

.4 The Contractor shall pay for all measures required for the SWPPP.

3.8 ALLOWANCES

Delete Section 3.8 in its entirety and substitute the following:

3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct and approve in writing. All unused allowance amounts shall be credited back to Owner, along with any markups included in the Contract Sum on such unused amounts.

3.9 SUPERINTENDENT

Delete Section 3.9.1 in its entirety and substitute the following:

3.9.1 The Contractor shall employ a competent superintendent, project manager and necessary assistants who shall be in attendance at the Project site during performance of the Work, including Punch List work. The superintendent and project manager shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications

given to the superintendent or project manager shall be binding as if given to the Contractor.

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

Delete Section 3.10.1 and substitute the following:

3.10.1 Within 30 days of being awarded an Amendment, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path clearly defined. The schedule shall not exceed time limits current under the Contract Documents. For further schedule requirements refer to specification section regarding project schedules in the Project Manual.

Add the following clause to Section 3.10.2:

3.10.2 Requirements for the submittal schedule are outlined in the specifications. If the Contractor fails to submit a submittal schedule or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in the Contract Sum or extension of the Contract Time based on the time required for review of submittals.

Add Section 3.10.4 as follows:

3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add Section 3.11.1 as follows:

3.11.1 The Contractor shall post all Addenda on Construction Documents prior to commencing work in the site.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

At Section 3.12.5, add the following Sections:

3.12.5 .1 If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

.2 The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.

At Section 3.12.7, correct the word "approved" in the last line to read "accepted".

At Section 3.12.8, correct "Architect's approval" in the last line to read "Architect's acceptance".

At Section 3.12.9, correct "Architect's approval" in the last line to read "Architect's acceptance" and add the following Section:

3.12.9.1 Deviation from the requirements of the Contract Documents indicated on shop Drawings, Product Data, and Samples, does not constitute the required notification "in writing.

Add Sections 3.12.11 and 3.12.12 as follows:

3.12.11 The Contractor shall submit complete Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents to the Architect at least thirty (30) days prior to the date the Contractor needs the reviewed submittals returned. Where colors are to be selected by the Architect, submit all Samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the contact for construction.

3.12.12 The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

Add Section 3.12.13 as follows:

3.12.13 The Contractor shall provide MEP coordination drawings within a schedule mutually agreed upon by the Team and prior to installing the Work, showing how all piping, ductwork, lights, conduit, equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be at ¼ inch per foot minimum scale and shall include invert elevations and

sections required to meeting intended purpose. The Contractor may propose an alternate method of accomplishing MEP coordination. If the alternate method is approved by the Team, it may be utilized.

3.14 CUTTING AND PATCHING

Add Section 3.14.3 as follows:

3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

3.15 CLEANING UP

Add Section 3.15.3 as follows:

3.15.3 Prior to the Architect's inspection for Substantial Completion the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

3.18 INDEMNIFICATION

Delete Sections 3.18.1 and 3.18.2 in their entirety and replace them with the following:

3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF EVERY TIER, EVEN IF THE BODILY INJURY, SICKNESS, DISEASE OR DEATH IS CAUSED BY OR ALLEGED TO HAVE BEEN CAUSED BY THE NEGLIGENCE, FAULT OR STRICT LIABILITY OF ANY OF THE INDEMNIFIED PARTIES.

FOR ALL CLAIMS NOT ADDRESSED IN THE ABOVE PARAGRAPH, CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES AND (COLLECTIVELY, THE "INDEMNIFIED PARTIES"), FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, OF ANY NATURE WHATSOEVER ARISING OUT OF OR RELATED TO THIS

AGREEMENT OR THE WORK TO BE PERFORMED UNDER THIS AGREEMENT, BUT ONLY TO THE EXTENT OF THE NEGLIGENCE OR OTHER FAULT OF THE CONTRACTOR, ITS AGENTS, REPRESENTATIVES, EMPLOYEES OR SUBCONTRACTORS OF ANY TIER.

3.18.2 It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall not be obligated under

Subparagraph 3.18 to indemnify or hold harmless Architect or any agent, servant of employee of Architect from liability or damage that is caused by or results from:

.1 Defects in plans, designs or specifications prepared, approved or used by the Architect; or

.2 Negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:

.1 personal injury or death;
.2 property injury; or
.3 any other expense that arises from personal injury, death or property injury.

Add Section 3.18.3 as follows:

3.18.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

Add Sections 3.19, 3.20, and 3.21 as follows:

3.19 RECORD DRAWINGS

3.19.1 Refer Owner's Closeout Procedures

3.20 PREVAILING WAGE RATES

3.20.1 As required by Chapter 2258 of the Texas Government Code Title 10 Prevailing Wage Rate, no employee used in this construction may be paid less than the minimum prevailing wage rate in effect for the Owner.

3.20.2 The Contractor and each Subcontractor and Sub-subcontractor shall pay to all laborers, workmen, and mechanics employed in execution of this Contract not less than rates set forth by law for each craft of type of workman or mechanic needed to execute this Contract.

3.20.3 Determination of prevailing wages shall not be construed to prohibit payment of more than the rates identified.

3.21 ANTITRUST VIOLATIONS

3.21.1 Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et.seq. (1973). The Contractor shall include this provision in his contracts with each Subcontractor and Supplier. Each Subcontractor shall include such provision in contracts with Sub-subcontractors and suppliers.

3.22 THIRD-PARTY BENEFICIARY

3.22.1 No person or entity shall be deemed to be a third-party beneficiary of any provision(s) of this Contract; nor shall any provision(s) hereof be interpreted to create a right of action or otherwise permit anyone not a signatory party to the Contract to maintain an action for personal injury or property damage.

ARTICLE 4 – ARCHITECT

4.2 Administration of the Contract

Delete Section 4.2.2 in its entirety and substitute the following:

4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner

against defects and deficiencies in the work, and (3) to determine in general if the work is being performed in a manner indicating that the work, when fully completed, will be in accordance with the Contract documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

Delete Section 4.2.6 in its entirety and substitute the following:

4.2.6 The Architect shall have authority to reject Work that does not conform to the Contract Documents. The Architect shall be required to promptly notify the Owner of any non-conforming Work and shall reject such non-conforming Work unless the Owner objects to the rejection in writing within twenty-four (24) hours of such notification. Whenever the Architect considers it necessary or advisable for implementation of the intent of the Contract documents, the Architect will have authority to require inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Performance of any additional inspection or testing, which would result in additional cost to the Owner, shall require advance notice to and approval of the Owner. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work, except when the Contractor's inability to perform the Work is a result of design flaw, error or omission.

Add the following Section 4.2.8.1:

4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

Delete Section 4.2.13 in its entirety and substitute the following:

4.2.13 All decisions on matters relating to aesthetic effect shall initially be made by the Architect; however, all such decisions are subject to the Owner's written approval.

ARTICLE 5 – SUBCONTRACTORS

5.1 DEFINITIONS

At the end of Section 5.1.1 add the following sentence:

Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

5.2

At the end of Section 5.2.4, add the following sentence:

Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

Delete the last sentence of Section 5.4.1 in its entirety and substitute the following:

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, but only to the extent permitted by law.

Delete the last sentence of Section **5.4.3** in its entirety.

ARTICLE 7 -- CHANGES IN THE WORK

7.1 GENERAL

Delete the text of Section 7.1.2 in its entirety and substitute the following:

7.1.2 A Change Order shall be based on agreement among the Owner, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents. A Construction Change Directive requires agreement by the Owner or the Owner's representative and Architect, and may or may not be agreed to by the Contractor; an order for a minor change may be issued by the Architect alone.

Add Section 7.5 as follows:

7.5 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

7.5.1 Unless otherwise directed, the procedure and markup of the costs for additional work shall be determined in the following manner:

.1 Upon Change Proposal request, the Contractor shall quote the cost for changes in the work showing separately, credits and additional costs broken down by headings used in the Schedule of Values. Further breakdown into units of labor and materials may be required if agreement on cost cannot be reached using the breakdown by headings. The final cost shall be the amount of the Total Contract Value Change shown on the Change Proposal signed by the Contractor and Owner. For general construction work, not subcontracted, the Contractor shall consider as costs the actual invoice amount for additional materials, the sales tax on additional materials when applicable, the wages paid for additional direct labor, plus the Contractor's usual markup of wages to cover additional labor related costs such as insurance, taxes and fringe benefits.

.2 On changes executed within the Owner's Contingency Allowance, Contractor shall have included costs for combined overhead and profit, to the extent permitted by the Contract Documents, and General Conditions costs, including the cost of superintendents, field office expense, temporary facilities and services, small hand tools, construction equipment not specifically provided for the change in hand, home office expense, bond and building insurance premiums, and managing the Subcontractor's work, in his Base Contract amount. Allowed overhead and profit fee on Owner's Contingency Allowance changes to be included in the total cost to the Owner shall be based as follows:

.1 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's of Sub-subcontractor's own forces, ten percent (10%) of the cost.

.2 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractors.

7.5.2 If any additional Work is authorized outside of or in excess of the Owner's Contingency Allowance, the combined overhead and profit for this work shall be based as follows:

.1 For the Contractor, for Work performed by the Contractor's own forces, a maximum total markup of ten percent (10%) of the actual cost on a lump sum project, or the Contractor's Construction Phase Fee on a Guaranteed Maximum Price Project.

.2 For Work performed by the Contractor's Subcontractor(s), five percent (5%) of the amount due the Subcontractor(s).

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

.4 For each Subcontractor, for work performed by the Subcontractor's Sub-subcontractors, five percent (5%) of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7.

7.5.3 In order to facilitate checking of quotations for extras or credits, all proposals, (except those so minor that their propriety can be seen by inspection), shall be accompanied by a complete and detailed itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

7.5.4 Change orders, as they are accepted by the Owner, shall be entered under heading “Change Orders” in the next current Request for Payment.

7.5.5 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5. All unused Contingency or Allowance amounts shall be credited back to Owner prior to final payment, along with any markups included in the Contract Sum or GMP on such unused amounts.

ARTICLE 8 -- TIME

8.1 DEFINITIONS

At Section 8.1.4, add the following sentence:

See further definition of “Day” in Section 1.9.10.

8.3 DELAYS AND EXTENSIONS OF TIME

Delete Section 8.3.1 in its entirety and substitute the following:

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other unforeseeable causes beyond the Contractor’s control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine. No extensions of the Contract Time will be granted for inclement weather, except for Force Majeure weather events consisting of named storms or government declared emergencies resulting from extreme weather.

Add Sections 8.3.4 and 8.3.5 as follows:

8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to the amount stated stated in the Contract Documents, per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. The liquidated damages assessed herein shall be Owner’s sole remedy for time delays between the deadline for substantial completion and Contractor’s achievement of substantial completion.

8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, within sixty (60) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to the amount stated in the Contract Documents, per phase, for each and every Calendar Day beyond the 60-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial Completion is not achieved by the agreed contract completion date, the Project close-out period of sixty (60) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

ARTICLE 9 -- PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

Add Section 9.1.1.1 as follows:

9.1.1.1 The Owner is exempt from payment of Texas State Sales Tax on materials required for the Work. Therefore, to comply with the law, the Contract Sum shall be broken down into the amount of cost for labor and the amount of cost for materials. This breakdown shall be provided by the Contractor within ten (10) days of award of Contract.

9.2 SCHEDULE OF VALUES

Add the following Sections:

9.2.1 General Contractor's cost for Contractor's fee, bonds and insurance, General Conditions, etc., shall be listed as individual line items.

9.2.2 Schedule of Values shall break each line into materials and labor. Once approved by the Owner and Architect, it shall be used as basis for reviewing Application for Payment but not be taken as evidence of market or other value.

9.2.3 Contractor's cost for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items.

9.2.4 On major subcontracts, such as mechanical, electrical, and plumbing, the Schedule shall indicate line items and amounts in detail, (for example; underground, major equipment, fixtures, installation of fixtures, start up, etc.)

9.2.5 Costs for subcontract work shall be listed without any addition of General Contractor's costs for overhead, profit or supervision.

9.2.6 The Contractor shall include a value for the coordination documents/drawings on the schedule of values.

9.2.7 The Contractor shall include a value for the correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant on the schedule of values for each sub-contractor subject to commissioning and test, adjust and balance requirements.

9.3 APPLICATIONS FOR PAYMENT

Delete Sections 9.3.1 and 9.3.2 in their entirety and replace them with the following:

9.3.1 Refer to Section 7.1.3 of the A133 Agreement for timelines related to Applications for Payment.

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

9.3.2 Payments will be made on account of materials or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 Surety must agree, in writing, to each request for payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment, without prior written approval of Owner.

The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

Add Section 9.3.4 as follows:

9.3.4 The Contractor shall submit requests for payment in duplicate, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

9.6 PROGRESS PAYMENTS

Delete Section 9.6.1 in its entirety and substitute the following:

9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make progress payments in accordance with the following Section and Section 7.1.3 of the A133.

.1 Based upon the applications for payment and supporting documents submitted to the Architect by the Contractor and certification of the amount payable by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period covered by the application for payment:

.2 Applications for Payment shall be submitted by the last day of the month. Not later than the last day of the following month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner.

.3 Upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

At Section 9.6.2, insert the following sentence between the first and second sentence:

More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub- subcontractors.

9.7 FAILURE OF PAYMENT

Delete the phrase “or awarded by binding dispute resolution.” Replace all references to “seven days” to “ten days.”

9.8 SUBSTANTIAL COMPLETION

At Section 9.8.2, add the following sentence at the end:

Should the Architect determine that the Contractor’s List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done.

Add Sections 9.8.6 and 9.8.7 as follows:

9.8.6 In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

.1 All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

.2 All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner’s opinion, cause interference to the Owner’s use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

The following items are a partial specific list of requirements, as applicable to the Project, that must be completed prior to established Substantial Completion of all portions of the work (Including the Substantial Completion of the commissioning phase).

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
3. All exterior clean-up and landscaping must be complete.
4. All final interior clean-up must be complete.
5. All HVAC air and water balancing must be complete.
6. All required commissioning must be complete.
7. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
8. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
9. All final lockset cores must be installed and all final Owner directed keying completed.
10. All room plaques and exterior signage must be completed.
11. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
12. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.

9.8.7 After the date of Substantial Completion of the Project is evidenced by the Certificate of Substantial Completion, the Contractor will be allowed a period of time within which to correct all deficiencies attached to the Certificate of Substantial Completion as outlined in Section 8.3.4 of these supplementary conditions. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the contractor's surety. In this report, the Contractor and surety will be informed that, should correction remain incomplete for fifteen (15) days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Article 14.2.

1 Should corrective work following Substantial Completion require more than one reinspection after notification by the Contractor that corrections are complete, the cost of subsequent inspections may also be deducted from the Contract funds remaining unpaid to the Contractor.

9.10 FINAL COMPLETION AND FINAL PAYMENT

At Section 9.10.2, add the following sentence at the end:
Prior to final payment, the Contractor shall meet all of the requirements of Owner's Closeout Procedures. Add Section

9.10.6 as follows:

9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor thirty-one (31) days after Substantial Completion of the Work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has then been completed, the Contract fully performed, all Contract Close Out Documents have been submitted, and the Final Certificate for Payment has been issued by the Architect. The final payment will not be made until all of these conditions have been satisfied.

ARTICLE 10 -- PROTECTION OF PERSONS AND PROPERTY

Add Sections 10.2.9 and 10.2.10 as follows:

10.2.9 The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.

10.2.10 The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

10.3 HAZARDOUS MATERIALS

Delete the text of Section 10.3.1 in its entirety and substitute the following:

10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents

regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Section 10.3.2.

Delete the text of Sections 10.3.3, 10.3.4 and 10.3.5 in their entirety. Delete the text

of Section 10.3.6 in its entirely and substitute the following:

10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a governmental agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all costs and expenses thereby incurred, but only to the extent provided by law.

Add Section 10.3.7 as follows:

10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

ARTICLE 11 -- INSURANCE AND BONDS

Delete the text of Sections 11.1 through 11.5 and substitute the following Sections:

11.1 CONTRACTOR'S LIABILITY INSURANCE

The Owner reserves the right to review the insurance requirements during the effective period of any Contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by Owner based upon changes in statutory laws, court decisions or potential increase in expense to loss.

11.2 The Owner requires the following minimum insurance coverages:

Types of Coverage	Limits of Liability	
Commercial General Liability	General Aggregate	$2,000,000.00
	Products / Completed Operations / Aggregate	$1,000,000.00
	Bodily Injury and Property Damage	$1,000,000.00
	Contractual	$1,000,000.00
	Personal and Advertising Injury	$1,000,000.00
	Fire Damage	$500,000.00
	Medical Expenses	$5,000.00

11.2.1 The Owner shall be named as an additional insured on a primary and noncontributory basis using form CG 2010 10 01 or similar endorsement providing equal or greater coverage in favor of the Owner.

Coverage shall include the following:

(a) Premises operations;
(b) Blanket Contractual Liability;
(c) Pollution;
(d) Products/Completed Operations;
(e) Broad Form Property Damage;

(f) Independent Contractors;
(g) Per project aggregate limit;
(h) Provide a statement of claims against the aggregate limit with each renewal certificate;
(i) X,C,U exclusions to be removed when underground work is performed; and
(j) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and
employees shall be provided.

11.2.2 Automobile Liability Combined Single Limit
$1,000,000.00

(a) Comprehensive Automobile Liability Insurance to cover all vehicles owned by, hired by, or used on behalf of the Contractor.

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.3 Workers' Compensation Statutory Limits

(a) Coverage at Statutory Limits with All States Endorsement

(b) Employer's Liability	Each Accident	$1,000,000.00
	Disease (Policy Limit)	$1,000,000.00
	Disease (Each Employee)	$1,000,000.00

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.4 Excess or Umbrella Insurance (provides coverage in excess of primary Commercial General Liability, Automobile Liability, and Worker's Compensation Coverage B limits)

(a) Minimum coverage for the Contractor shall be one (1) times the Contract amount, subject to a minimum limit of $1,000,000.00 and a maximum limit of $25,000,000.00. Limits for primary policies may differ from those shown above when Excess (Umbrella) Insurance coverage is provided.

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.3 The Owner requires that the following insurance requirements be satisfied:

.1 No Work shall be commenced until all insurance requirements set forth in this Agreement have
been approved by the Owner in writing.

.2 All insurance policies and certificates required hereunder shall be in form and content
satisfactory to the Owner.

.3 The Owner shall be furnished an ACORD form Certificate of Insurance evidencing all policies and
endorsements required by this Agreement prior to execution of the Contract and thereafter upon
renewal or replacement of each required policy of insurance.

.4 Each Insurance coverage/policy shall contain a provision that at least thirty (30) days prior written

notice shall be given to the Owner in the event of cancellation, material change, or non-renewal.

.5 Insurance shall be underwritten by a company licensed to do business in Texas, satisfactory to

Owner and rated minimum A-VII by A.M. Best.

.6 The insurance coverages specified herein shall be maintained at all times during the term of the

contract and, with the exception of builder's risk coverage, shall be maintained for a minimum of one

(1) year thereafter.

.7 No deletions/exclusions from the standard coverage form are allowed without the prior written consent

of the Owner.

.8 All insurance must be issued on an occurrence basis.

.9 The Contractor shall be responsible for all deductibles; the Owner shall approve the deductibles

selected.

.10 With the exception of Excess Umbrella Coverage, the coverage afforded by each carrier must be a

primary over any other applicable insurance.

.11 In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the

Owner as Additional Insured, and (b) showing waivers of subrogation in favor of the Owner.

11.4 PERFORMANCE BOND AND PAYMENT BOND

Add the following Sections:

11.4.1 The Contractor shall provide a Performance Bond, in the penal sum equal to one hundred percent (100%) of the Contract Sum, if the formal Contract is in excess of One Hundred Thousand Dollars ($100,000.00) and a Labor and Material Payment bond, in the penal sum equal to one hundred percent (100%) of the Contract sum if the formal contract is in excess of Twenty Five Thousand Dollars ($25,000.00).

11.4.2 The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an attached authorized power of attorney. Such Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of a least A-X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570).

11.4.3 The Performance Bond Form and the Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work. The surety companies must be acceptable to the Owner and licensed admitted carriers in the State of Texas; and the companies must appear in a current Federal Treasury list as Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds land as Acceptable Reinsuring companies.

11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

11.4.5 Claims must be sent to the Contractor and his Surety in accordance with Article 5160, Revised Civil Statutes. The Owner will furnish in accordance with such Article, a copy of the Payment Bond as provided therein to claimants upon request. All claimants are cautioned that no lien exists on the funds unpaid to the contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his Surety. The Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no responsibility because of any representation by any agent or employee.

11.5 WORKER'S COMPENSATION INSURANCE COVERAGE

11.5.1 Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities

11.5.2 DEFINITIONS:

.1 Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing service as on a project, for the duration of the project.

.2 Duration of the project –includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include without limitation, providing hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

11.5.3 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

11.5.4 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

11.5.5 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

11.5.6 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

.1 A certificate of coverage, prior to that person beginning work on the projects so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project, and

.2 No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

11.5.7 The Contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal

delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

11.5.9 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack coverage.

11.5.10 The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any

coverage agreements, which meet the statutory requirements of Texas Labor code, Section 401.011(44) for

all of its employees providing services on the project, for the duration of the project.

.2 Provide the Contractor, prior to that person beginning work on the project, a certificate of coverage showing

that coverage is being provided for all employees of the person providing services on the project, for the

duration of the project.

.3 Provide the Contractor, prior to the end of the coverage period shown on the current certificate ends during

the duration of the project.

.4 Obtain from each other person with whom it contracts, and provides to the Contractor:

.1 A certificate of coverage, prior to the other person beginning work on the project, and

.2 A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if

the coverage period shown on the current certificate of coverage ends during the duration of the project.

.5 Retain all required certificates of coverage on file for the duration of the project and for one year thereafter.

.6 Notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the

person knew or should have known, of any change that materially affects the provision of coverage of any

person providing services on the project, and

.7 Contractually require each person with whom it contracts, to perform as required by these subsections

(1)-(7), with the certificates of coverage to be provided to the person for whom they are providing services.

11.5.11 By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to

administrative penalties, criminal penalties, civil penalties, or other actions.

11.5.12 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

ARTICLE 12—UNCOVERING AND CORRECTION OF WORK

12.2.1 BEFORE SUBSTANTIAL COMPLETION

After Section 12.2.1 add the following Sections:

12.2.1.1 In the event of failure of a specified project, either during construction or the correction period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

12.2.1.2 Refer to Owner's Closeout Procedures for further terms regarding warranties which will be required prior to final payment.

12.2.2 AFTER SUBSTANTIAL COMPLETION

After Section 12.2.2 add the following Section:

12.2.2.1 Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

12.3 ACCEPTANCE OF NONCONFORMING WORK

Number the existing provision as Section 12.3.1, and add Section 12.3.2 as follows:

12.3.2 The Owner's use and/or occupancy of any or all of the Project site shall never be construed as an acceptance of Work not in conformance with Contract Documents. The Owner reserves the right to enforce provisions of the Contract unless the Owner's acceptance is provided to the Contractor in writing.

ARTICLE 13—MISCELLANEOUS PROVISIONS

Add Sections 13.7, 13.8 and 13.9 as follows:

13.7 EQUAL OPPORTUNITY

13.7.1 The contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

13.8 CRIMINAL BACKGROUND CHECKS

The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Owner's Board Policy CJA and the form included herein, as required by Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, and shall comply with all requirements of such laws and policy.

13.9 REQUIRED CERTIFICATIONS

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of com
contracts with, or provide supplies or services to, a foreign organization designated as a Foreign T
the U.S. Secretary of State under federal law. Contractor hereby certifies and verifies that neither C
affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts
agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agr
of this Agreement, the term "boycott" shall mean and include terminating business activities or othe
that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or w
doing business in Israel or in an Israeli-controlled territory.

ARTICLE 14—TERMINATION OR SUSPENSION OF THE CONTRACT

Delete the text of Section 14.1.3 in its entirety and substitute the following:

14.1.3 If one of the reasons described in Section 14.4.1 or 14.4.2 exists, the Contractor may, upon seven day's written notice to the Ower and Architect, terminate the Contract and recover from the Owner payment for Work executed as of the date of the notice, plus costs of demobilization.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

Delete the text of Section **14.4.3** in its entirety and substitute the following:

14.4.**3** In the case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

ARTICLE 15—CLAIMS AND DISPUTES

15.1 CLAIMS

Delete the text of Section **15.1.1** in its entirety and substitute the following:

15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner, Architect, and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. Nothing herein shall require the Owner to make or file a Claim in order to assess liquidated damages provided for in the Contract Documents.

15.1.2 TIME LIMITS ON CLAIMS

Delete the last sentence of Section 15.1.2 in its entirety.

15.1.3 NOTICE OF CLAIMS

Delete the second sentence of Section 15.1.3 in its entirety and substitute the following:

Claims by either party must be initiated within ninety (90) days after occurrence of the event giving rise to such Claim or within ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

15.1.6 CLAIMS FOR ADDITIONAL TIME

Delete the text of Section 15.1.6.2 in its entirety and substitute the following:

15.1.6.2 No extenstions of the Contract Time will be granted for inclement weather, except as provided in Section 8.3.1.

15.1.7 CLAIMS FOR CONSEQUENTIAL DAMAGES

Delete the text of Section 15.1.7 in its entirety.

15.2 INITIAL DECISION

Delete the text of Section 15.2.1 in its entirety and substitute the following:

15.2.1 Claims, excluding those alleging an error or omission by the Architect or those arising after expiration of the period for correction of the Work, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

Delete the text of Section 15.2.5 in its entirety and substitute the following:

15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefore; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties, but subject to mediation, if both parties so agree, and subject to legal or equitable proceedings in a court having jurisdiction thereof. It is understood and agreed that, in the event that any dispute, controversy, or conflict arises during the design and construction of the Project or following its completion, the parties hereto will cooperate in good faith, if possible, to resolve the issues without resorting to litigation.

Delete the text of Sections 15.2.6 and 15.2.6.1 in

their entirety. Add the following Section 15.2.9

15.2.9 The prevailing party in any judicial proceeding arising from the Contract Documents shall recover its reasonable and necessary attorneys' fees.

15.3 MEDIATION

15.3.1 Delete the text of 15.3.1 in its entirety.

Delete Section 15.3.2 in its entirety and replace with the following:

15.3.2 The parties may mutually agree to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing unless stayed for a longer period of agreement of the parties or court order.

15.4 ARBITRATION

Delete the text of Sections **15.4.1** through **15.4.3** and **15.4.4.1** through **15.4.4.3** in their entirety.

END OF DOCUMENT

SECTION 00 73 43 - WAGE RATES

General

A. Requirements:

1. Pay not less than the minimum wage scale and benefits indicated on the "Prevailing Wage Rates" schedule provided herein.
2. Wages listed are minimum rates only.
3. No claims for additional compensation shall be considered by the Owner be-cause of payments of wage rates in excess of the applicable rate contained in this contract.

B. Penalty for Violations - Texas Government Code section 2258.023(b) (Vernon Pamphlet 1998) states as follows: "A contractor or subcontractor who violates this section shall pay to the Owner, $60 for each worker employed for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract."

C. Payroll Records - Pursuant to Texas Government Code section 2258.024 (Vernon Pamphlet 1998), the Contractor and all subcontractors shall keep records showing: (a) the name and occupation of each worker employed by the contractor or subcontractor in the construction of the public work; and (b) the actual per diem wages paid to each worker. These records shall be open at all reasonable hours to inspection by the officers and agents of the Owner.

PREVAILING WAGE SCALE NOTICE

D. Minimum Wage Rates - Pay prevailing basic wage listed, plus any applicable fringe benefits.

E. This determination of prevailing wages shall not be construed to prohibit the payment of more than the rates named. Under no condition shall any laborer, workman or mechanic employed on this job be paid less than the minimum wage scale.

F. In execution of this contract, the contractor shall comply with all ap-plicable state and federal laws, including but not limited to laws con-cerned with labor, equal employment opportunity, safety, and minimum wage.

G. Apprentice Pay-All Trades and Crafts - The minimum rate for apprentices shall be in accordance with the scale determined by an approved apprenticeship program or $1.00 per hour less than journeymen's rates, whichever is lower. An approved apprenticeship program is one approved by the U.S. Department of Labor, Bureau of Apprenticeship Training, and only apprentices enrolled in an approved program may be paid apprenticeship rates.

H. Base Per Diem Rate - Hours Worked/Day Times Base Hourly Rate

I. Multipliers for Overtime Rates:

1. Over 40 hours per week: Base hourly rate times 1.5

2. Holidays: Base hourly rate times 1.5

June 2022 to June 2025 Prevailing Wages Rates

Bricklayer/Mason	$	18.87
Carpenter/Caseworker	$	20.38
Carpet Layer/Floor Installer	$	19.81
Concrete Finisher	$	14.21
Data Communications /Telecom Installer	$	22.72
Drywall Installer/Ceiling Installer	$	16.98
Electrician	$	26.92
Elevator Mechanic	$	34.85
Equipment Operator - Heavy Equip	$	19.50
Equipment Operator - Light Equip	$	13.90
Glazier	$	20.61
Insulator	$	15.17
Insulator - Building	$	11.35
Insulator - Mechanical Piping	$	10.85
Ironworker	$	22.81
Laborer	$	12.07
Laborer - Skilled	$	13.24
Laborer - Unskilled	$	10.12
Lather	$	18.82
Millwright	$	23.57
Painter/Wall Covering Installer	$	15.83
Pipefitter	$	27.66
Plasterer	$	20.25
Plumber	$	31.64
Roofer	$	15.70
Sheet Metal Worker	$	19.81
Sprinkler Fitter	$	24.10
Steel Worker Structural	$	19.97
Terrazzo Worker	$	17.15
Tile Setter	$	16.13
Truck Driver	$	14.33
Welder	$	15.00
Waterproofer /Caulker	$	15.46

END OF SECTION

SECTION 01 10 00 - SUMMARY OF WORK AND SCHEDULING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Project description.
2. Work sequence.
3. Contractor's use of premises.
4. Owner occupancy.
5. Owner-furnished items.
6. Specification conventions.

1.2 PROJECT DESCRIPTION

A. The Project consists of construction and related sitework of the new **Elementary School #23** located in Rosesharon, Texas on Inspiration Way near Meridiana Parkway, as indicated on the Contract Documents prepared by Stantec Architecture and consultants, dated **AUGUST 18, 2025**.

B. The Work consists of Civil, Landscape, Structural, Architectural, Mechanical, Electrical, Plumbing, and Fire Protection requirements as indicated in the Project drawings and specifications.

1.3 REQUIRED COMPLETION DATES

A. The Work shall be conducted according to the following schedule to ensure that the Owner has sufficient opportunity to ready the facility for occupancy and permit an orderly transfer of personnel, furnishings, and equipment.

1. Start Date for On-Site Construction: Approximately **November 3, 2025**
*Subject to change based on successfully obtaining a Permit for Construction. The contractor shall not incur any cost for staffing, mobilizing, or construction until a notice to proceed is submitted by Alvin ISD.
2. Project Substantial Completion Date: On or before **March 1, 2027**

1.4 CONTRACTOR USE OF PREMISES

A. The Contractor's use of the designated portions of the premises is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the Project.

B. Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public for areas outside the limits of construction.
1. Confine operations to areas within the limits indicated. Portions of the premises beyond areas in which construction operations are indicated are not to be disturbed.
2. Keep driveways and entrances serving other portions of the premises clear and available to the Owner, the Owner's employees, and the public at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

1.5 OWNER OCCUPANCY

A. Partial Owner Occupancy of Completed Areas: The Owner reserves the right to occupy and to place and install equipment in completed areas prior to Substantial Completion provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.
   2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.
   3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.6 OWNER-FURNISHED ITEMS

A. The Owner will furnish certain items, including **paper towel dispensers, paper towel disposals, toilet tissue dispensers, refrigerators, stoves, ice makers, and washer/dryers.** The Work includes providing support systems to receive Owner's equipment, and service and utility connections as required for the intended use of the item(s).
   1. The Owner will arrange and pay for delivery of Owner-furnished items in accordance with the Contractor's Construction Schedule and will inspect deliveries for damage.
   2. If Owner-furnished and delivered items are damaged by Owner, received defective, or are missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field services, and the delivery of manufacturer's warranties and bonds to the Contractor.
   3. The Contractor is responsible for coordinating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner- furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations.

1.7 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION

SECTION 01 21 00 – COST ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements governing handling and processing Allowances.

B. Related Sections:
   1. Section 01 22 00 - Unit Prices: Procedures for submitting and handling Unit Prices.
   2. Section 01 26 00 - Modification Procedures: Procedures for submitting and handling Change Orders.
   3. Section 01 40 00 - Quality Requirements: Use of allowances for inspection and testing agencies.

1.2 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.3 CONTINGENCY ALLOWANCES

A. Use the Owner’s contingency allowance only as directed for the Owner's purposes, and only by Contingency Fund Change Orders which designate amounts to be charged to the allowance.
   1. The Contractor's related costs for products or equipment ordered by the Owner under the contingency allowance, including delivery, installation, taxes, insurance, equipment rental, and similar costs are not part of the Contract Sum.
   2. CONTRACTOR shall include mark-up for overhead and profit for all allowances in their Base Proposal. No additional mark up, including labor burden, will be allowed on individual items provided under the allowances. This includes labor and material supplied by the CONTRACTOR and any SUB-CONTRACTORS.
   3. For change orders outside of allowances noted in the document, the CONTRACTOR will be allowed to add mark up for overhead and profit as stipulated in the contract documents.
   4. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order or transfer the remaining amounts to other allowances as directed by the Architect.

1.4 UNUSED MATERIALS

A. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

B. Where it is not economically feasible to return unused material for credit and when requested by the Architect, prepare unused material for the Owner's storage, and deliver to the Owner's storage space as directed. Otherwise, disposal of excess material is the Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect products covered by an allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related construction activities.

3.3 SCHEDULE OF ALLOWANCES

A. **Allowance Number 1 – Owner's Contingency Allowance:**

Include the sum of **$700,000.00** for use upon the Owner's instruction.

B. **Allowance Number 2 – Unforeseen Subsurface Conditions Allowance:**

Include the sum of **$100,000.00** for the approved removal or mitigation of unforeseen subsurface materials or conditions during earthwork operations.

C. **Allowance Number 3 – Authority Review Comments Allowance**:

Include the sum of **$100,000.00** for revisions to proposed design and construction as may be required by the City or County in review of construction documents for permitting.

D. **Allowance Number 4 – BDA Emergency Responder Radio System**:

Include the sum of **$100,000.00** for the contractor to bid and coordinate the installation of the BDA system once the building walls are up and the building is fully dried in. The Owner will coordinate the testing when appropriate and approve the installer.

END OF SECTION

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for unit prices.

1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
2. Unit prices all necessary material, labor, overhead, profit and applicable taxes.
3. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

B. Schedule: A "Unit Price Schedule" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods described under each unit price.

1. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this Work measured by an independent surveyor acceptable to the Contractor at the Owner's expense.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

A. Unit Price No. 1 – Additional Structural Steel: If additional structural steel is required, bid unit pricing shall be used in adjusting the Contract Price.
1. Structural Steel, price per Ton.

B. Unit Price No. 2 – Site Fill Haul Off: If additional dirt is required to be hauled off the site, bid unit pricing shall be used in adjusting the Contract Price.
1. Dirt haul off, price per 1,000 cubic yards

C. Unit Price No. 3 – Additional Site Fill: If additional dirt is required to be imported and compacted on the site, bid unit pricing shall be used in adjusting the Contract Price.
1. Dirt imported, price per 1,000 cubic yards

D. Unit Prices No. 4 – Additional Duplex Outlet and Associated Wiring: If additional duplex outlets are required, the following unit price shall be used in adjusting the Contract Price.
1. Duplex outlet, price per Box, Device, and Wiring (100’ max distance from panel) – Metal Stud pre-wall enclosure.
2. Duplex outlet, price per Box, Device, and Wiring (100’ max distance from panel) – Metal Stud post-wall enclosure where the box needs to

be cut in (not surface mounted).
3. Duplex outlet, price per Box, Device, and Wiring (100' max distance from panel) – CMU pre-wall installation.
4. Duplex outlet, price per Box, Device, and Wiring (100' max distance from panel) – CMU post-wall installation where the box needs to be cut in (not surface mounted).

E. Unit Price No. 5 – Additional Data (2D) Outlet and Associated Trim Out, Connection and Wiring - If additional data outlets are required, the following unit pricing shall be used in adjusting the Contract Price.
1. Data outlet, price per Box, Device, and Wiring (300' max distance) – Metal Stud pre-wall enclosure.
2. Data outlet, price per Box, Device and Wiring (300' max distance) – Metal Stud post-wall enclosure where the box needs to be cut in (not surface mounted).
3. Data outlet, price per Box, Device and Wiring (300' max distance) – CMU pre-wall installation.
4. Data outlet, price per Box, Device and Wiring (300' max distance) – CMU post-wall installation where the box needs to be cut in (not surface mounted).

F. Unit Price No. 6 – Hardware: If additional hardware sets are required or recovered, the following unit prices shall be used in adjusting the Contract Price.
1. Additional Door Hardware: HW Set (typical classroom).
2. Additional Door Hardware: HW Set (typical office).

G. Unit Price No. 7 – Additional concrete placement: If additional concrete is required and approved by the Project Engineer, the following unit price shall be used in adjusting the Contract Price.
1. Grade Beams, price per cu. yd.
2. Slab on grade, price per cu. yd.
3. Concrete slab on metal deck, price per cu. yd.

H. Unit Price No. 8 – Additional Reinforcing Steel: If additional reinforcing steel is required, the following unit price shall be used in adjusting the Contract Price. Unit price shall include furnishing, fabricating and installing reinforcing.
1. Reinforcing steel, price per lb.

I. Unit Price No. 9 – Additional Metal Deck (non-acoustical deck): If additional metal deck is required, the following unit price shall be used in adjusting the Contract Price. Unit price shall include furnishing, fabricating and installing the metal deck.
1. Metal deck for floor slab, price per sq. ft.
2. Roof deck (non-acoustical), price per sq. ft.

END OF SECTION

SECTION 01 23 00 – ALTERNATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for Alternates.

1. Definition: An Alternate is an amount proposed by Proposers and stated on the Proposal Form for certain construction activities defined in the Proposal Requirements that may be added to or deducted from Base Proposal amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

2. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.

3. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

4. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.

a. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.

b. The Owner reserves the right to accept any, none or all of the Alternates for a period of 30 days after receipt of proposals. Should the Owner-Contractor Agreement be executed prior to Owner acceptance of an Alternate, the Alternate will be accepted by Change Order at the original bid amount within 30 days after receipt of proposals.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **ALTERNATE NO. 1 – FLOORING**

1. Base Bid: Corridor Flooring to be Solid Vinyl Tile as shown on the drawings
2. Alternate: Corridor Flooring to be Epoxy Terrazzo
3. Note: One Alternate price for both floors.

B. **ALTERNATE NO. 2 – Not Used**

C. **ALTERNATE NO. 3 – Lighting Package**

1. Base Bid: No Lighting Package
2. Alternate 3a: Putterman Scharck
3. Alternate 3b: CW Lighting
4. Alternate 3c: Lighting Associates
5. Note: Refer to the electrical lighting schedule

D. **ALTERNATE NO. 4 – Base Bid Adjustment**

1. Base Bid: No change to base bid price
2. Alternate: Any adjustment up or down to the base bid price.
3. Note: The intent is that the other Alternates are true bids up or down for the work detailed within them. This alternate is intended for any adjustments to the base bid up or down.

END OF SECTION

SECTION 01 25 13 - PRODUCT SUBSTITUTIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made both prior to receipt of bids and after as herein specified.

B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittal Requirements."

C. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

D. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Product Requirements."

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor 10 days prior to receipt of bids are considered requests for substitutions. The following are not considered substitutions:
   1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents.
   2. Revisions to Contract Documents requested by the Owner or Architect.
   3. Specified options of products and construction methods included in Contract Documents.
   4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBSTITUTIONS

A. Substitution Request Submittal: Requests for substitution will be considered if received at least 10 days prior to bid date. Requests received after commencement of the Work may be considered or rejected at the discretion of the Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form attached in this section and in accordance with procedures required for Change Order proposals.
   2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
   3. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
   4. Samples, where applicable or requested.

5. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
6. Coordination information, including a list of changes or modifications required for other parts of the Work (or to related construction performed by the Owner and any separate contractors) that will become necessary to accommodate the proposed substitution.
7. A statement indicating the substitution's effect on the Anticipated Project Schedule and Contract Construction Schedule after award of contract compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
8. Cost information, including a proposal of the net change, if any, from the specified product or assembly, or the contract sum.
9. **Construction Manager at Risk Projects**: No substitutions will be considered either during or after subcontractor bidding that are not accompanied by this fully executed form including approval signature of the CMAR.
10. **Competive Sealed Proposal Projects**: No substitutions will be considered AFTER selection of the successful General Contractor that are not accompanied by this fully executed form including approval signature of the Contractor.
11. Certification by the Vendor, Subcontractor Bidder, CMAR or General Contractor certifies that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Certification includes the waiver of rights by any party to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately, or additional payment for any required modification of related materials or construction.

B. ENVIRONMENTAL AND HEALTH CERTIFICATIONS
1. Reference Section 01 33 00 “Submittals” for additional submittal requirements for certain materials indicated in the Materials and/or Finish Schedules regarding “Environmental and Health Certifications”. Such “E&H” certificates and labels are to be provided by the material manufactures and are to be included with the product submittals.

1.5 Architect's Action: If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the specified product only. Acceptance of the proposed substitution will be in the form of an Addendum which lists all prior-approved products prior to award of Contract and a Change Order after the award of Contract.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Conditions: The Bidder's or Contractor's substitution request will be received and considered by the Architect when all of the mandatory conditions are satisfied and one or more of the optional conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
1. Mandatory Conditions:
a. Submitted as required prior to bidding.
b. Extensive revisions to Contract Documents are not required.
c. Proposed changes are in keeping with the general intent of Contract Documents.
d. The request is timely, fully documented and properly submitted.

2. Optional Conditions:
a. The request is directly related to an "or equal" clause or similar language in

the Contract Documents.

b. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

c. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

d. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

e. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Bidder or Contractor certifies that the substitution will overcome the incompatibility.

f. The specified product or method of construction cannot be coordinated with other materials, and where the Bidder or Contractor certifies that the proposed substitution can be coordinated.

g. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Bidder or Contractor certifies that the proposed substitution provide the required warranty.

h. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

2.2 FAILURE OF TIMELY ORDER

A. The contractor is responsible for assuring the timely order of all materials specified. If a specified material or color of material cannot be delivered by the contract completion date, due to failure to order the material in a timely manner, the contractor shall be responsible for supplying an equal or better material. The Architect shall be the sole determinant of the approved substitute material.

B. The contractor shall also be charged an amount equal to 5% of the value of the specified material. This amount shall be credited to the owner through a change order to the contract.

C. The word "material", as used in this section, includes all items specified in the specifications or shown on the drawings.

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

(SUBSTITUTION REQUEST FORM ATTACHED)

STANTEC
Project Manager
910 Louisiana Street, Suite 2600
Houston, Texas 77002
713.548.5700

PRODUCT AND MATERIAL SUBSTITUTION REQUEST FORM

(This substitution request form must be used for **Pre-Proposal** Substitution Requests or **Post - Proposal** Substitution Requests as specified in Divisions 1 Section -"Product Substitutions".)

Project:_____

From (company): _____ Date:_____

Address:_____Telephone:_____

[ ] Bidding G.C. [ ] CM @ Risk [ ] Bidding subcontractor [ ] Bidding vendor or manufacturer

Substitution approval is an acceptance of only the manufacturer and product for general conformance with the design concept reflected in the Contract Documents. The A/E has made no attempt to verify specific performance data, or to check the details of the proposed substitution as to special features, capacities, physical dimensions or code and/or regulatory compliance, all of which remain the responsibility of the person/entity submitting the proposed substitution.

Specified Product:_____

Specification Title:_____ Section No._____

Page No. _____ Paragraph No._____ or previous Addendum No. _____

Proposed
Substitution:_____

Manufacturer:_____ Phone:_____

Model/Series Number:_____ Trade Name _____

Area Distributor_____Contact _____ Phone_____

History: [ ] New product [ ] 2-5 years old [ ] More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

Similar Installations:
(attach any additional related project listings)

Project	Architect	Phone
Address		Year Installed

Owner Contact		Phone
_____	_____	_____
Project	Architect	Phone
_____		_____
Address		Year Installed
_____		_____
Owner Contact		Phone

Proposed substitution affects other parts of work: [ ] No [ ] Yes

If Yes, explain_____

Estimated Cost Savings to Owner (if substitution is proposed by G.C.) [ ] negligible [ ] $ _____

Time Savings for Project (if substitution is proposed by G.C.) [ ] none [ ] saved days [ ] extra days

Supporting Data Attached: [ ] Drawings [ ] Product Data [ ] Samples [ ] Tests [ ] Reports [ ] Other:
Note: Comparative data sufficient for Owner / Architect / General Contractor evaluation is required.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- For items where color/pattern is named in the documents, proposed color/pattern of the substituted item will be the equivalent, with the final determination made by the Architect.
- Equal or better warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule except as may be clearly identified above.
- Claims for additional costs for this substitution (other than costs clearly indicated above), are the responsibility of the entity making this request.
- Substitutions affecting minor dimensions and clearances are identified herein, and it is the responsibility of the entity requesting the substitution to coordinate such with the Contractor. Approval of such changes is the sole responsibility of the Architect.

Signature of Person Submitting: _____ Title_____

Printed Name: _____ email _____

A/E's RESPONSE (**Accepted substitutions will be included in written addendum issued prior to bidding):**

[ ] Substitution rejected for non-compliance……Use specified materials.
[ ] Substitution rejected for lack of data……Use specified materials.
[ ] Substitution Request received too late……Use specified materials.

[ ] Substitution conditionally approved – Provide submittals after bidding per Division 1 Section "Submittals".
[ ] Plus noted exceptions: _____

Copied to: [ ] Owner [ ] General Contractor [ ] _____ [ ] _____

For any Product Substitution Request submitted at any time for a Construction Manager at Risk project, or after bidding is complete for a Competitive Sealed Proposal project, this form must be approved for submittal by the CMAR or successful General Contractor as identified herein:

_____	_____	_____	_____
Signed	Printed name and title	Date	Vendor/Subcontractor
_____	_____	_____	_____
Signed	Printed name and title	Date	CMAR / GC

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 1 Section "Allowances" for procedural requirements governing the handling and processing of allowances.
   2. Division 1 Section "Submittals" for requirements for the Contractor's Construction Schedule.
   3. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
   4. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 MINOR CHANGES IN THE WORK

A. Instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect as part of a request for information on a Request for Interpretation Form as included in the Division-1 Section "Submittals".

B. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions.

1.4 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
   1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
   2. Unless otherwise indicated in the proposal request, within 20 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
   3. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Furnish survey data to substantiate quantities and costs on Providers' letterheads, including, but not limited to, Subcontractors' letterheads.
   4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   5. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Furnish survey data to substantiate quantities and costs on Providers' letterheads, including, but not limited to, Subcontractors' letterheads.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests.

1.5 ALLOWANCES

A. Allowance Adjustment: Base each Change Order Proposal Request for an allowance cost adjustment solely on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in the purchase amount only where indicated as part of the allowance.
   2. Prepare explanations and documentation to substantiate the margins claimed.
   3. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.
   4. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

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

1.7 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 – PRODUCTS: Not Used
PART 3 – EXECUTION: Not Used

END OF SECTION

SECTION 01 29 00 - APPLICATIONS FOR PAYMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. The Contractor's Construction Schedule and Submittal Schedule are included in Section "Submittals".

1.3 SCHEDULE OF VALUES

A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
   a. Contractor's construction schedule.
   b. Application for Payment form.
   c. List of subcontractors.
   d. Schedule of allowances.
   e. Schedule of alternates.
   f. List of principal suppliers and fabricators.
   g. Schedule of submittals.
   h. Include separate line items for project closeout and record documents

2. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 10 days before the date scheduled for submittal of the initial Application for Payment.

3. Sub-Schedules: Where the Work is separated into phases that require separately phased payments provide sub-schedules showing values of each schedule correlated with each phase of payment.

4. Where the Contractor anticipates invoicing for materials prior-to or separately-from installation, such line items shall be separated into labor and material costs.

5. Identification: Include the following Project identification on the Schedule of Values:
   a. Project name and location.
   b. Name of the Architect.
   c. Project number.
   d. Contractor's name and address.
   e. Date of submittal.

6. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items and use no less detail than the level of line-item detail in the Project Manual Table of Contents.

7. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

8. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

9. Margins of Cost: Show line items for indirect costs, and margins on actual costs and list individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost.

10. Overhead and Profit: Show separate line item value for overhead and profit.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown as separate line items in the Schedule of Values.

11. Schedule Updating: List Change Orders as a separate line item when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

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

   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

B. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement. Modification to payment application times shall occur if agreed to by all concerned parties at the pre-construction meeting.

C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheet G 703, or a similar form, as the form for Application for Payment.

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

E. Transmittal: Submit 3 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours.
   1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

F. Waivers of Mechanics Lien: Owner reserves the right to require Wavers of Mechanics Lien with each Application for Payment. Submit waivers of liens from subcontractors or sub-subcontractors and suppliers for the period covered by the previous application.
   1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.

2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
    a. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
        1.) Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.
    b. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
    1. List of subcontractors.
    2. List of principal suppliers and fabricators.
    3. Schedule of Values.
    4. Contractor's Construction Schedule (preliminary if not final).

H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
    1. Completion of Project closeout requirements.
    2. Completion of items specified for completion after Substantial Completion.
    3. Assurance that unsettled claims will be settled.
    4. Assurance that Work not complete and accepted will be completed without undue delay.
    5. Transmittal of required Project construction records to Owner.
    6. Removal of temporary facilities and services.
    7. Removal of surplus materials, rubbish and similar elements.
    8. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
   1. Coordination.
   2. Administrative and supervisory personnel.
   3. General installation provisions.
   4. Cleaning and protection.

B. Field engineering is included in Section "Field Engineering".

C. Progress meetings: coordination meetings and pre-installation conferences are included in Section "Project Meetings".

D. Requirements for the Contractor's Construction Schedule are included in Section "Submittal Procedures".

1.3 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
      a. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   4. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project Close-out activities.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
   1. Show the interrelationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Comply with requirements contained in Section "Submittals."
   4. Refer to Division-15 Section "Basic Mechanical Requirements," and Division-16 Section "Basic Electrical Requirements" for specific coordination drawing requirements for mechanical and electrical installations.

B. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
   1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the

necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

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

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities 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. Where applicable, such exposures include, but are not limited to, the following:
1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High speed operation,
21. Improper lubrication,
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION

SECTION 01 30 10 - MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.1 REQUIREMENTS

A. Provide necessary work and services required for the complete installation of heating, ventilating, air conditioning, plumbing, and electrical systems in the buildings as shown on the Drawings. For convenience, Drawings showing primarily HVAC have been numbered with an “M”, Drawings showing primarily electrical have been numbered with an “E” and Drawings showing; primarily plumbing have been numbered with a “P”.

B. Make installations in a manner that shall comply with applicable codes and laws. Where the requirements of Contract Documents exceed code requirements, comply with the Contract Documents.

C. Perform electrical Work in accordance with the latest edition of the national Electrical code as minimum standards of quality and safety.

D. Comply with: (ADA) Americans Disability Act and (TAS) Texas Accessibility Standards requirements.

1.2 RELATED REQUIREMENTS

A. Section 01 73 29 – Cutting and Patching.

B. Section 01 31 19 – Project Meetings.

C. Section 01 30 00 – Administrative Requirements.

D. Section 01 33 00 – Submittal Requirements.

E. Section 01 60 00 – Product Requirements: Product options and substitutions.

F. Section 01 70 00 – Execution and Closeout Requirements.

1.3 REQUIREMENTS FOR EQUIPMENT

A. Provide equipment with necessary parts and accessories even though the parts and accessories are not specifically mentioned herein.

B. Provide a factory applied finish on all exterior surfaces. Tough up or refinish items which have the finish marred, before final acceptance.

C. Rotating parts shall be in static and dynamic balance.

D. Electrical materials shall bear the stamp of approval of the Underwriter’s Laboratory.

E. Noise: Eliminate any abnormal noises, which are not an inherent part of the systems as designed. Abnormal buzzing and rattling of equipment, piping, ducts, and air devices and squeaks in rotating equipment components will not be acceptable.

1.4 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to jobsite until progress of construction has reached the stage

where equipment is actually needed, or until equipment can be stored inside building to protect equipment from the weather. Equipment allowed to stand in weather will be rejected, and new equipment of a like kind shall be used.

B. Adequately protect equipment from damage after delivery to job site. Cover with heavy drop cloths as required to protect from plaster, dirt, paint, water, adverse weather conditions, and physical damage.

C. Equipment which has been damaged by construction activities will be rejected, and new equipment of a like kind shall be used.

D. At time of Substantial Completion, equipment shall be clean.

E. Insulation material that becomes wet shall be rejected and replaced at no additional cost to Owner.

1.5 OPERATING MANUALS, SERVICE DATA, AND WARRANTIES

A. Upon completion of the project, provide service manuals for each type unit of equipment provided in the project as described in Section 01 70 00 – Execution and Closeout Requirements.

B. Warranties: In addition to the one year warranty specified in the Conditions of the Contract, assume all responsibility for special guarantees which may be required in this specification concerning installation, operation or performance of equipment, materials, and systems provided by a distributor, manufacturer or subcontractor.

1.6 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 – Submittal Procedures, Supplementary Conditions and individual specification sections.

B. Equipment and material submittals shall show sufficient data to indicate complete compliance with Contract Documents as follows:
1. Proper sizes and capabilities.
2. Ability to fit in the available space in a manner that will allow proper service.
3. Construction methods, materials, and finishes.
4. List of accessories.

C. Product data shall include the contract item designation, building, and proposed model number.

D. If proposed air devices are different than models specified, indicate the specified model and beside it the proposed model for each type of device. Do not list quantities.

E. For any item to be installed in or on a finished surface (such as a tee bar, acoustical ceiling, plaster wall) certify that applicable Contract Documents have been checked and that the item submitted is compatible with the surface finish on which it is to be installed.

F. Show Drawings: Sheet metal, piping, mechanical, and electrical fabrication Shop Drawings shall show equipment, ductwork, and piping, including piping in plumbing chases, sized and drawn in exact location to be installed. Produce Drawings in 1/4 inch scale with all ductwork and piping sized accordingly. Ductwork and piping larger than 3 inches shall be shown with double lines.

G. Coordination Drawings: Coordination Drawings are Drawings which indicate relationships between the various systems and other components of the building such as beams, columns, ceilings, and walls. They shall be drawn to 1/4 inch scale and shall include plans, elevations, sections, and other details as required to clearly define the relationships of the various components. Indicate ducts, conduits, sprinkler systems, light fixtures, piping, and miscellaneous equipment on one drawing for each floor or level. Refer to Mechanical and Electrical Specifications for additional requirements. Submit these within two months of award of contract.

H. Interference Drawings:
1. Interference Drawings are supplementary to Coordination Drawings and indicate conflict between the various systems and other components of the building such as beams, columns, and walls. They shall be drawn to 1/4 inch scale and shall include plans, elevations, sections, and other details as required to clearly define the interference and to indicate the Contractor's proposed solution.

2. Submit Drawings for approval whenever job measurements and an analysis of the Drawings and specifications by the Contractor indicate that the various systems cannot be installed without significant deviation from the intent of the Contract. When such an interference is encountered, Work shall cease in the general areas of the conflict until a solution to the question has been approved by the Architect.

I. All Submittals shall be bound into book form with a table of contents listing all items in that specific submittal. Loose catalog sheets or drawings will not be acceptable. A separate brochure will be required for each type of equipment; e.g., lighting fixtures, switchgear, lighting panels, clock system, mechanical equipment, plumbing items, and ductwork accessories, each in a separate brochure. Miscellaneous apparatuses such as transformers contactors, time switches, and safety switches may be contained in one brochure.

J. Auxiliary system submittals shall contain sufficient information to show conformance with the specifications and shall include a description of the operation of each system to aid the consultant in the evaluation of each submittal.

PART 2 – PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 MANUFACTURER'S DIRECTIONS AND SUPERVISION

A. Follow manufacturer's directions for installation, testing, and operation of all apparatuses and equipment provided.

B. Where supervision by a manufacturer is required in the specification, pay all costs and follow all instructions and recommendations of the manufacturer, who shall supervise the installation, connection, startup adjustment, instruction of the Owner, and final tests of equipment and systems. Where two or more manufacturer's equipment is interrelated, coordinate the Work and supervision.

C. Provide a letter from the manufacturers whose supervision is required stating that they have supervised the installation and their equipment or system is operating satisfactorily in detail and in every respect and that the Owner's representative has been instructed in the operation and maintenance.

3.2 COORDINATION

A. Coordinate the mechanical and electrical Work with that of other trades in order that the various components of the systems shall be installed at the proper time, shall fit the available space, and shall allow proper service access to those requiring maintenance, including equipment specified in other Divisions.

B. Remove and relocate items which are installed without regard to proper access as directed by the Consultant, at no additional cost to the Owner.

C. Provide materials with trim to match and fit properly with the types of adjacent ceiling, wall, and floor finishes actually installed. Model numbers in specifications or scheduled on Drawings are not intended to designate the required trim.

D. Provide mechanical equipment with electrical characteristics compatible with that shown on Electrical Drawings and described in electrical Division of the specifications.

E. Prior to the fabrication of ductwork or the installation of devices in the ceilings, review the Drawings to ascertain that the locations of devices in the ceilings create a pattern which is compatible with the reflected ceiling plan and the spacings of the various ceiling mounted devices.

3.3 DRAWINGS

A. The Contract Drawings are schematic in nature, but indicate how the various components are integrated with other parts of the building. Determine exact locations by job measurement, by checking the requirements of other trades, and by review of Contract Documents.

B. The Drawings indicate general routing of the various parts of the systems, but do not indicate all sizes, fittings, offsets, and runouts which are required. Provide correct sizes, fittings, offsets, and runouts required to fit the system into spaces allocated to them. Locate all light fixtures, vents, and supply grilles to conform to the ceiling grid system. Examine the Drawings to become familiar with this requirement.

C. In certain instances, the Architect may require relocation of outlets and switches. Where relocation is within 3 feet of location shown on Drawings, and when Contractor is informed of necessary relocation before Work is begun on this portion of the job, no extra compensation will be allowed.

END OF SECTION

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
   1. Pre-Construction Conference.
   2. Pre-Installation Conferences.
   3. Coordination Meetings.
   4. Progress Meetings.

B. Construction schedules are specified in another Division-1 Section.

1.3 PRE-CONSTRUCTION CONFERENCE

A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress including such topics as:
   1. Tentative construction schedule.
   2. Critical Work sequencing.
   3. Designation of responsible personnel.
   4. Procedures for processing field decisions and Change Orders.
   5. Procedures for processing Applications for Payment.
   6. Distribution of Contract Documents.
   7. Submittal of Shop Drawings, Product Data and Samples.
   8. Preparation of record documents.
   9. Use of the premises.
   10. Office, Work and storage areas.
   11. Equipment deliveries and priorities.
   12. Safety procedures.
   13. First aid.
   14. Security.
   15. Housekeeping.
   16. Working hours.

1.4 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The 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 the Architect of scheduled meeting dates.

B. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
   1. Contract Documents.
   2. Options.
   3. Related Change Orders.
   4. Purchases
   5. Deliveries.
   6. Shop Drawings, Product Data and quality control Samples.
   7. Possible conflicts.
   8. Compatibility problems.
   9. Time schedules.
   10. Weather limitations.
   11. Manufacturer's recommendations.
   12. Compatibility of materials.
   13. Acceptability of substrates.
   14. Temporary facilities.
   15. Space and access limitations.
   16. Governing regulations.
   17. Safety.
   18. Inspection and testing requirements.
   19. Required performance results.
   20. Recording requirements.
   21. Protection.

C. Record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Owner and Architect.

D. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.\

1.5 COORDINATION MEETINGS

A. Conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

E. The pre-install conferences may include, but are not limited to:
   1. Site Utilities
      a. Attendees include Architect, Owner, Civil Engineer
   2. Concrete
      a. Attendees include Architect, Owner, Civil Engineer, Material Testing

3. Plumbing & Electrical
   a. Attendees include Architect, Owner, MEP Engineer, AISD MEP
4. Athletic Fields and Field Irrigation
   a. Attendees include Architect, Owner, Athletic Consultant
5. Playground
   a. Attendees include Architect, Owner
6. Fencing
   a. Attendees include Architect, Owner
7. Duct/Mech
   a. Attendees include Architect, Owner, MEP Engineer, AISD MEP
8. Roofing
   a. Attendees include Architect, Owner, Envelope Consultant
9. Wall Systems (Masonry, Waterproofing, Glazing, Insulation)
   a. Attendees include Architect, Owner, Envelope Consultant, Material Testing Lab
10. Drywall
    a. Attendees include Architect, Owner
11. Plaster
    a. Attendees include Architect, Owner
12. Communications –Phone, Security Alarm
    a. Attendees include Architect, Owner, MEP Engineer, AISD Technology
13. Paint
    a. Attendees include Architect, Owner
14. Landscaping and Irrigation
    a. Attendees include Architect, Owner, Landscape Architect, AISD Landscaping
15. HVAC Controls
    a. Attendees include Architect, Owner, MEP Engineer, Testing and Balancing Consultant, AISD Energy Manager
16. Carpet/VCT/Acoustic Ceilings/Terrazo/ All Flooring
    a. Attendees include Architect, Owner
17. MEP Exposed Ceilings
    a. Attendees include Architect, Owner, MEP Engineer
18. Sound System
    a. Attendees include Architect, Owner, MEP Engineer, AISD Technology
19. Wall Coverings
    a. Attendees include Architect, Owner
20. Kitchen Equipment
    a. Attendees include Architect, Owner, MEP Engineer, Food Service Consultant, Manufacturer’s Rep
21. Tiling
    a. Attendees include Architect, Owner
22. Fire Alarm
    a. Attendees include Architect, Owner, MEP Engineer, AISD Compliance Coordinator
23. Access Control
    a. Attendees include Architect, Owner, MEP Engineer, AISD Compliance Coordinator
24. Hardware
    a. Attendees include Architect, Owner, Hardware Consultant

25. Casework
    a. Attendees include Architect, Owner
26. Cabling (All) Low Voltage, Network
    a. Attendees include Architect, Owner, MEP Engineer, AISD Technology

1.6 PROGRESS MEETINGS

A. Conduct progress meetings at the Project sites once a week, or biweekly as the stage of work dictates. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

D. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind 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 the present and future needs of each entity present, including such items as:
        a. Interface requirements.
        b. Time.
        c. Sequences.
        d. Deliveries.
        e. Off-site fabrication problems.
        f. Access.
        g. Site utilization.
        h. Temporary facilities and services.
        i. Hours of Work.
        j. Hazards and risks.
        k. Housekeeping.
        l. Quality and Work standards.
        m. Change Orders.
        n. Documentation of information for payment requests.

E. Reporting: No later than 3 days after each progress meeting date, the contractor shall distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

    1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 32 00 - NOTIFICATION OF ARCHITECT REQUIREMENTS

PART 1 – GENERAL

1.1 REQUIREMENTS

A. In general, the Contractor shall notify the Architect whenever there is need of clarification of interpretation of the Contract Documents.

B. The Contractor shall notify the Architect 48 hours in advance of certain stages of construction. The project superintendent shall notify the Owner's Representative on an ongoing basis of ongoing work. These stages shall include, but not necessarily be limited to the following:

1. Division 2 – Demolition of any existing facilities or site features.

2. Division 3.
   a. Excavation of grade beams.
   b. Installation of concrete underlayment, underslab vapor barriers, water proofing.
   c. Installation of reinforcing and formwork
   d. Placing of concrete.

3. Division 4
   a. Placing of masonry, grout, and reinforcement
   b. Block, brick, and stone placement, glass unit masonry, masonry cleaning.

4. Division 5
   a. Erection of structural steel, open web steel joists, and steel deck.
   b. Miscellaneous metals, ladders, brackets, pipe rails, etc.

5. Division 6 - Finish Carpentry and Millwork.

6. Division 7
   a. Installation of waterproofing, vapor barriers, flashing and sheet metal.
   b. Installation of roofing system(s) and associated work.
   c. Concealment of insulation.
   d. Application of fireproofing.
   e. Installation of firestopping and firesafing.
   f. Installation of building and glazing sealants.

7. Division 8
   a. Installation of doors, frames, windows, and storefronts.
   b. Installation of rolling and coiling doors and grilles.
   c. Installation of finish hardware.
   d. Installation of glazing and glazed systems.

8. Division 9
   a. Installation of plaster and gypsum board products.
   b. Installation of tile, flooring, and pavers.
   c. Installation of acoustical ceiling (grid and panels).
   d. Installation of resilient flooring and base.
   e. Painting and staining (each coat).

9. Division 10
    a. Installation of specialty items, markerboards, display cases, projection screens, signage and graphics, canopies.
    b. Installation of operable walls and folding partitions.
    c. Installation of toilet accessories.

10. Division 11
    a. Installation of appliances.
    b. Installation of Stage Equipment.

11. Division 14 – Installation of elevators.

12. Division 21
    a. Installation of sprinkler piping.
    b. Installation of sprinkler heads.

13. Divisions 22, 23 and 26
    a. Completion of roughing-in of plumbing, heating, air conditioning and electrical work (prior to concealment).
    b. Any testing specified for mechanical, electrical and plumbing systems.
    c. Inspection and testing of underground utilities.

14. Division 22 - Installation of plumbing fixtures.

15. Division 23 - Installation of heating, ventilating and air conditioning.

16. Division 26 - Installation of all electrical fixtures.

17. Division 31
    a. Site clearing and stripping of top soil.
    b. Excavation for building foundation.
    c. Placing and compaction of each lift of select fill material.
    d. Drilling of foundation piers.
    e. Covering of underground utilities.
    f. Site grading.

18. Division 32
    a. Stabilization of paving subgrades.
    b. Installation of concrete paving.
    c. Installation of running track subgrade, base, and wearing course.
    d. Installation of athletic turf.
    e. Installation of decorative metal fencing.
    f. Installation of topsoil.
    g. Installation of landscaping.

PARTS 2 and 3 - Not Used

END OF SECTION

SECTION 01 32 23 - SURVEY AND LAYOUT DATA

PART 1 G E N E R A L

1.1 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Owner's Representative if required by the Contract.

1.2 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit name, address, and telephone number of Surveyor to Owner's Representative before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contract.

1.3 PROJECT RECORD DOCUMENTS

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

B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.

C. Submit record documents under provisions of Division 1.

1.4 EXAMINATION

A. Verify locations of survey control points prior to starting the Work.

B. Notify Owner's Representative immediately if any discrepancies are discovered.

1.5 SURVEY REFERENCE POINTS

A. The Owner will establish survey control datum as indicated on Drawings. Inform Owner's Representative in advance of time additional horizontal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to the Owner or Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Owner's Representative a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.

D. Promptly report loss or destruction of reference points to Owner's Representative.

E. Reimburse the Owner for cost of reestablishment of permanent reference points disturbed by construction operations.

1.6 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.

C. Establish elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:
   1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs.
   2. Grid or axis for structures.
   3. Building foundation, column locations, and ground floor elevations.

D. Periodically verify layouts.

1.7 AS-BUILT SURVEY REQUIREMENTS

A. Detention Ponds:
   1. If a detention pond is included in scope of work, Contractor shall provide Owner and Engineer an As-Built survey of said detention pond for volume verification prior to seeding/sodding or covering pond. Contractor shall provide two hard copies and one AutoCAD file with points.
   2. For open ponds, survey shall include enough information for Engineer to perform volume verification calculations. Items shall include but not be limited to: top of bank delineation and elevations, toe of slope delineation and elevations, pilot channels (or center swale) and elevations, and inflow/outflow structures. Survey grid shall be 50’ maximum. Survey shall extend a minimum of 20’ outside top of bank of pond.
   3. For below grade (underground) ponds, survey shall include but not be limited to: layout of below grade structure including pipe sizes, box culvert sizes, etc. and flowlines of structure.
   4. As-Built survey shall be signed and sealed by a registered Land Surveyor.

B. Outfalls to Harris County Flood Control (HCFC) Channels:
   1. HCFC requires an As-Built Certificate for all newly constructed outfalls to their facilities. The Contractor shall provide Owner and Engineer an As-Built Certificate of any newly constructed outfalls to HCFC facilities. The As-Built survey shall include but is not limited to: detailed sketch of outfall, flowline of outfall, size and pipe type of outfall and flowline of existing channel. Survey shall include area of at least 20’ around outfall.
   2. As-Built survey shall be signed and sealed by a registered Land Surveyor.

C. Sites located in the 100-year Floodplain:
   1. Sites located in the 100-year Floodplain will require an As-Built Certificate. Contractor shall provide Owner and Engineer an As-Built Survey (2 hard copies) of completed site for use in filling out said As-Built Certificate. Survey shall include but is not limited to: finished floor elevation(s) of all slabs (including recessed interior slabs, raised interior slabs and bottom of elevator pits), paving elevations, outside mechanical equipment elevations (A/C units, chillers, compressors, etc.) and all fill placed within 100-year floodplain. Survey shall include entire site.
   2. Contractor shall coordinate with Engineer for exact Governmental requirements prior to survey.
   3. As-Built survey shall be signed and sealed by a registered Land Surveyor.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N – Not Used

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Other Related Sections:
   1. 01 30 10 – Mechanical and Electrical Coordination.
   2. 01 33 10 – BIM Coordination Process.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
   1. Contractor's construction schedule.
   2. Submittal schedule.
   3. Daily construction reports.
   4. Shop Drawings.
   5. Product Data.
   6. Samples.
   7. Requests for Interpretation or Information.
   8. Environmental and Health Certificates or labels for certain materials as required.

B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
   1. Permits.
   2. Applications for payment.
   3. Performance and payment bonds.
   4. Insurance certificates.
   5. List of Subcontractors.

C. The Schedule of Values submittal is included in Section "Applications for Payment."

D. Inspection and test reports are included in Section "Quality Control Services."

1.3 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals only after receipt of acceptable waiver from Contractor.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
      a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
   3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
   4. Allow two weeks for initial review. Allow additional time if processing must be delayed to

permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
   a. If an intermediate submittal is necessary, process the same as the initial submittal.

5. Allow two weeks for reprocessing each submittal.
   a. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
   1. Prior to forwarding to Architect, include Contractor's stamp on transmittal, each shop drawing sheet, and each bound set of data indicating Contractor's review and acceptance of submittal. Contractor's notations regarding exceptions, requirements, or deviations from Project requirements are to be clearly indicated.
   2. Do not provide multiple submittals under one transmittal. Provide separate transmittal for each item.
   3. Include the following information on the transmittal and submittal for processing and recording action taken.
      a. Listing of the product(s) or system(s) b or
      b. Number of the related specification section plus sequential number of the particular submittal (for instance: **05 21 00 -1** for initial submittal of Steel Joists). Verify numbering system with Architect.
      c. Project name.
      d. Date.
      e. Name of Architect.
      f. Name of Contractor.
      g. Name of submitting subcontractor or supplier.
   4. Title block on shop drawings shall include the following:
      a. Project name.
      b. Date.
      c. Name of Contractor.
      d. Name and contact number of subcontractor or supplier as appropriate.
      h. Name or initials of person producing the shop drawings.
   5. Submittals rejected or returned to the sender for additional information are not to be forwarded to the Architect. Forwarding a submittal to the Architect indicates Contractor's acceptance of the submittal as meeting Project requirements.

D. Electronic (PDF) Submittals are to be provided in lieu of hard-copies. Architect will utilize file transfer protocol "Newforma" to receive, transfer, and manage submittals routed from Contractor to Architect and associated Consultants.
   1. No purchase of special software is required by the Contractor to interface with "Newforma".
   2. Brief training regarding the use of this system will be provided upon request at the Architect's office for Contractor's personnel.

E. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using electronic transmittal form. Submittals received from sources other than the Contractor will be returned or discarded without action.
   1. Record on the transmittal Record relevant information and requests for additional information.
   2. Clearly and conspicuously indicate on transmittal and shop drawings any deviations from Contract Document requirements, including a non-specified product or manufacturer, any variations, or limitations. Architect's review and acceptance of submittals is not binding where such deviations are not CLEARLY NOTED.

3. Include Contractor's certification of review that submitted product(s) complies with Contract Document requirements except as CLEARLY NOTED.

F. Owner will have access to viewing and commenting on submittals concurrently with A/E, and the Architect will incorporate any Owner comments prior to return of submittals.

1.4 SHOP DRAWINGS AND COORDINATION DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
   1. Dimensions.
   2. Identification of products and materials included.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.

C. Provide digital copies of shop drawings unless A/E specifically requests hard copy drawings for a particular submittal.
   1. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
   2. Number of Copies: Submit three black-line prints for the Architect's or Architect’s Consultant’s review; one print will be returned with comments, or scanned and returned through Architect’s digital file transfer protocol.
   3. Contractor shall make copies necessary for his own use, for field copies, and copies of reviewed submittals to be included in maintenance manuals

D. Steel Shop Drawings (Division 5): To expedite the Architect’s and Engineer’s review of the structural steel Shop Drawings, submit Shop Drawings for items specified in the following sections separately from those of Section 05 12 00 - Structural Steel Framing, even when furnished by the same fabricator:
   1. Section 05 50 00 - Metal Fabrications.
   2. Section 05 51 00 - Metal Stairs.
   3. Section 05 52 00 - Metal Railings
   4. Section 05 53 00 - Metal Gratings.

E. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
   1. Preparation of coordination Drawings is specified in other sections of the Project specifications and may include components previously shown in detail on Shop Drawings or Product Data.
   2. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

1.5 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

B. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
   1. Manufacturer's printed recommendations.
   2. Compliance with recognized trade association standards.
   3. Compliance with recognized testing agency standards.
   4. Application of testing agency labels and seals.
   5. Notation of dimensions verified or requiring verification by field measurement.
   6. Notation of coordination requirements.

C. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

D. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required. Do not submit manufacturer’s pamphlets or catalogs without the particular items for consideration CLEARLY indicated.

E. Number of Copies: Provide digital copies of Product Data unless A/E specifically requests hard copies for a particular submittal:
   1. Submit three copies for the Architect's or Consultant’s review; one copy will be returned with comments, or scanned and returned through Architect’s digital file transfer protocol.
   2. Contractor shall make copies necessary for his own use, for field copies, and copies of reviewed Product Data to be included in maintenance manuals.

F. Field Copies: Following receipt of reviewed and accepted submittal from Architect, print and file copy of reviewed submittal in the Project meeting room and field office. Field copy shall include all review markings.
   1. Do not proceed with installation until a copy of the final Product Data submittal is in the installer's possession.

1.6 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
   1. Include transmittal with information as identified above in Submittal Procedures. Number product on the transmittal per the approved numbering system. In many cases the sample will be retained by the Architect with only the transmittal returned with comments.
   2. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's Sample. Include the following:
      a. Generic description of the Sample.
      b. Sample source.
      c. Product name or name of manufacturer.
      d. Compliance with recognized standards.
   3. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
   4. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
   5. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
   6. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal,

indicate special requests regarding disposition of Sample submittals.

B. Preliminary samples: Where Samples are for initial selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
   1. Preliminary samples will be reviewed and may be returned with the Architect's mark indicating initial selection.
   2. Maintain approved samples, if returned, at the Project site, for quality comparisons throughout the course of construction.
   3. Unless noncompliance with Contract Document provisions is observed, the initial submittal may also serve as the final sample.

C. Distribution of Samples: Distribute additional sets of approved samples to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work.
   1. Field Samples or “mockups” specified in individual Sections are special types of Samples. Field Samples are full-size mockups erected, installed, or applied on site to illustrate finishes, coatings, or quality of installation, and to establish the standard by which the Work will be judged.
   2. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity
   3. As part of Closeout Documents, Contractor shall provide a binder with samples of all materials included in Completed Work. Samples shall be separated by Specification Section.

1.7 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.
   1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
   2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
      a. Scheduled date for delivery of each submittal to the Architect.
      b. Submittal category.
      c. Name of subcontractor.
      d. Description of the part of the Work covered.
      e. Anticipated date for return of Architect’s reviewed copy.

B. Field Copies: Following receipt of reviewed and accepted submittal from Architect, print and file copy of reviewed submittal in the Project meeting room and field office. Field copy shall include all review markings.

1.8 ARCHITECT'S REVIEW OF SUBMITTALS

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each architectural submittal, mark to indicate action taken, and return promptly.
   1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

C. Final Release: Where submittals are marked "No Exceptions," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

D. Final-But-Restricted Release: When submittals are marked "Exceptions Noted" or "Make Corrections Noted", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

E. Returned for Resubmittal: When submittal is marked "Revise and Resubmit", do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

F. Where subcontractor or supplier elects to make corrections based on notations by the Contractor, Architect, or consultants and the submittal has NOT been marked "Revise and Resubmit", do not copy the Architect with revised drawing unless specifically corrected.

G. Do not permit submittals marked "Revise and Resubmit" to be used at the Project site, or elsewhere where Work is in progress

1.9 CONTRACTOR'S CONSTRUCTION SCHEDULE

B. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit within 30 days of the date established for "Commencement of the Work".
   1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
   2. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
   3. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
   4. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
   5. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.

D. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
   1. When revisions are made, distribute 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 construction activities.

E. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.10 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; make report available to the Architect and Owner at the Project site:

1. List of subcontractors at the site.
2. Approximate count of personnel at the site.
3. Weather-related conditions at the actual site including temperature, precipitation, muddy or wet site conditions. No claims for additional weather days can be made without daily weather entries in the log.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, losses.
7. Orders and requests of governing authorities.
8. Services connected, disconnected.
9. Equipment or system tests and start-ups.
10. Partial Completions, occupancies.
11. Substantial Completions authorized.

1.11 REQUESTS FOR INTERPRETATION - All contractor requests for interpretation pertaining to all aspects of the construction documents and this Project shall be submitted on the form attached, or on the Construction Specification Institute form, CSI Form 13.2A, “Request For Interpretation” or a similar form provided by the Contractor.

1.12 Environmental and Health Certifications or Labels (for example: Cradle to Cradle, EPD, HPD, and other certifications and labels): Furnish copies of documents showing proof of certification or label as indicated on the Project’s Interior and/or Exterior Finish Schedule. Submit the information with the other Submittal Data for Basis-of-Design products, equal products by specified manufacturers, and proposed substitution products.

A. Proposed substitutions shall comply with the following: The Project’s Interior and/or Exterior Finish Schedule, or Color Schedule, may be labelled in the drawings as something other than the “Interior Finish Schedule” or “Exterior Finish Schedule”.

B. For a product to be used in lieu of the Basis-of-Design product listed in the specs or on the Interior Finish Schedule, a proposed as-equal product supplied by manufacturers listed in the specifications that is not the Basis-of-Design product, the proposed comparable product shall have a certification or label which is equal to, or better than the Basis-of-Design product.

C. A proposed as-equal product to be used in lieu of the Basis-of-Design product listed in the Specifications or on the Interior Finish Schedule, a product supplied by manufacturers not listed in the specifications or the Interior Finish Schedule, the proposed comparable product shall have a certification or label which is equal to, or better than the Basis-of-Design product.

D. If a question about which certification or label is better than or exceeds the indicated certification, contact the project’s Architect for direction.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.

1. The Owner will engage the services of an independent agency to perform some of the inspections and tests specified in PART 3 - EXECUTION, QUALITY CONTROL, QUALITY CONTROL TESTING DURING CONSTRUCTION or FIELD QUALITY CONTROL. Payment for these services will be made by the Owner.
   a. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.

2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the

Contractor's responsibility.

a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.

3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
   a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
   b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
   c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
   d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
   e. Security and protection of samples and test equipment at the Project site.

B. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.

1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.

C. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
3. The agency shall not perform any duties of the Contractor.

D. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. Additionally, Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.4 SUBMITTALS

A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

B. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

C. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
   1. Date of issue.
   2. Project title and number.
   3. Name, address and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making the inspection or test.
   6. Designation of the Work and test method.
   7. Identification of product and Specification Section.
   8. Complete inspection or test data.
   9. Test results and an interpretation of test results.
   10. Ambient conditions at the time of sample-taking and testing.
   11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting.

1.5 QUALITY ASSURANCE

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
   1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01 42 19 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

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

B. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.

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

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

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

F. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide: The term provide means furnish and install, complete and ready for the intended use.

I. Installer: An Installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

J. Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

K. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements

over which the Contractor has no choice or option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

1. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

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

M. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere and to report and interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's MASTERFORMAT numbering system.

1. Text Subordination: Portions of the Specification may be subordinated to other portions in the following manner:
   a. Certain Sections may be subordinate to other Sections or parts of other Sections. When that occurs, the degree of subordination is described in those Sections.
   b. Paragraphs and lines of text are subordinate to article titles.
   c. Paragraphs and lines of text that are indented from the left hand margin are subordinate to the preceding text that is either not indented or indented by a lesser amount.

2. Underscoring, Bold Letters and Bold Numbers are used strictly to assist the reader in scanning for key words. No emphasis or relative importance is intended for text where underscoring, bold letters and bold numbers are used.

B. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

C. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated, as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

D. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1. The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if

bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different but apparently equal and other uncertainties to the Architect for a decision before proceeding.

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

E. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.
2. The Architect reserves the right to require the Contractor to submit copies of standards as necessary for enforcement of requirements.

F. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the Text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

G. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean the associated names. Names and addresses are subject to change and are believed, but not ensured, to be accurate and up to date as of the date of Contract Documents.

AA	Aluminum Association 900 19th St., NW, Suite 300 Washington, DC 20006	www.aluminum.org (202) 862-5100
AABC	Associated Air Balance Council 1518 K St., NW Washington, DC 20005	www.aabchq.com (202) 737-0202
AAMA	American Architectural Manufacturers Assoc. 1540 E. Dundee Road, Suite 310 Palatine, IL 60067	www.aamanet.org (847) 303-5664
AAN	American Association of Nurserymen 1250 I St., NW, Suite 500	(see ANLA)

	Washington, DC 20005	(202) 789-2900
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., Suite 249 Washington, DC 20001	www.aashto.org (202) 624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Dr. Research Triangle Park, NC 27709-2215	www.aatcc.org (919) 549-8141
ABMA	American Bearing Manufacturers Assoc. 1200 19th St., Suite 300 Washington, DC 20036	www.abma-dc.org (202) 367-1155
ABMA	American Boiler Manufacturers Association 950 North Glebe Rd., Suite 160 Arlington, VA 22203	www.abma.com (703) 522-7350
ACI	American Concrete Institute P.O. Box 19150 Detroit, MI 48219	www.aci-int.org (248) 848-3700
ACIL	American Council of Independent Laboratories 1629 K St., NW Washington, DC 20006	www.acil.org (202) 887-5872
ACPA	American Concrete Pipe Association 8618 Westwood Center Dr., Suite 105 Vienna, VA 22182	www.concrete-pipe.org (972) 506-7216
ADC	Air Diffusion Council 11 South LaSalle St., Suite 1400 Chicago, IL 60603	www.flexibleduct.org (312) 201-0101
AFBMA	Anti-Friction Bearing Manufacturers Assoc. (Now ABMA)	
AFPA	American Forest and Paper Association 1111 19th St., NW, Suite 800 Washington, DC 20036	(See AF&PA) (202) 463-2700
AF&PA	American Forest & Paper Association	www.afandpa.org
AGA	American Gas Assoc. 1515 Wilson Blvd. Arlington, VA 22209	www.aga.org (202) 824-7000
AGC	Associated General Contractors of America	www.agc.org (703) 548-3118
AHA	American Hardboard Assoc. 1210 W. Northwest Highway	www.ahardbd.org

	Palatine, IL 60067	(847) 934-8800
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Dr., Suite 1500 Chicago, IL 60606	www.aham.org (202) 872-5955
AI	Asphalt Institute Research Park Dr. P.O. Box 14052 Lexington, KY 40512-4052	www.asphaltinstitute.org (859) 288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006	www.e-architect.com (202) 626-7300
AIA	American Insurance Assoc. 1130 Connecticut Ave., NW, Suite 1000 Washington, DC 20036	www.aiadc.org (202) 828-7100
AIHA	American Industrial Hygiene Assoc. 2700 Prosperit Ave., Suite 250 Fairfax, VA 22031	www.aiha.org (703) 849-8888
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001	www.aisc.org (800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., NW Washington, DC 20036-4700	www.steel.org (202) 452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112	www.aitc-glulam.org (303) 792-9559
ALA	American Laminators Association 419 Norton Building Seattle, WA 98104-1584	(See LMA) (206) 622-0666
ALI	Associated Laboratories, Inc. c/o HOH Chemicals 500 S. Vermont St. Palatine, IL 60067	www.associatedlabs.org (800) 685-0026
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875	www.alsc.org (301) 972-1700
AMCA	Air Movement and Control Assoc. 30 W. University Dr. Arlington Heights, IL 60004-1893	www.amca.org (847) 394-0150
ANLA	American Nursery & Landscape Association (Formerly: AAN – American Association of Nurserymen)	www.amac.org (202) 789-2900

ANSI	American National Standards Institute 11 West 42nd St., 13th Floor New York, NY 10036	www.ansi.org (202) 293-8020
AOAC	AOAC International 2200 Wilson Blvd., Suite 400 Arlington, VA 22201-3301	www.aoac.org (703) 522-3032
AOSA	Association of Official Seed Analysts 201 N. 8th St., Suite 400 P.O. Box 81152 Lincoln, NE 68501-1151	www.aosaseed.com (402) 476-3852
APA	APA-The Engineered Wood Association (Formerly American Plywood Assoc.) P.O. Box 11700 Tacoma, WA 98411	www.apawood.org (253) 565-6600
API	American Petroleum Institute 1220 L St., NW Washington, DC 20005	www.api.org (202) 682-8000
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203	www.ari.org (703) 524-8800
ARMA	Asphalt Roofing Manufacturers Assoc. Public Information Department 1156 – 15th Street, N.W., Suite 900 Washington, DC 20005	www.asphaltroofing.org (202) 207-0917
ASA	Acoustical Society of America Suite 1NO1 2 Huntington Quadrangle Melville, NY 11747 – 4502	http://asa.aip.org (516) 576-2360
ASC	Adhesive and Sealant Council 7974 Old Georgetown Road, Suite 500 Bethesda, Maryland 20814	www.ascouncil.org (301) 986-9700
ASCA	Architectural Spray Coaters Association 895 Doncaster Drive Paulsboro, NJ 08066	www.ascassoc.com (856) 848-6120
ASCE	American Society of Civil Engineers 345 East 47th St. New York, NY 10017-2398	www.asce.org (703) 295-6300 (800) 548-2723
ASHE	American Society for Healthcare Engineering One North Franklin, 28th Floor Chicago, IL 60606	www.ashe.org (312) 422-3800 (800) AHA-2626
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	www.ashrae.org

	1791 Tullie Circle, NE Atlanta, GA 30329-2305	(404) 636-8400 (800) 527-4723
ASME	American Society of Mechanical Engineers International 345 East 47th St. New York, NY 10017	www.asme.org (800) 843-2763 (212) 591-7722
ASPA	American Sod Producers Assoc.	(Now TPI)
ASPE	American Society of Plumbing Engineers 8614 Catalpa Avenue, Suite 1007 Chicago, IL 60656-1116	www.aspe.org (773) 693-2773
ASSE	American Society of Sanitary Engineering P.O. Box 40362 Bay Village, OH 44140	www.asse-plumbing.org (440) 835-3040
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428	www.astm.org (610) 832-9585
	ATIS Alliance for Telecommunications Industry Solutions 1200 G St., NW, Suite 500 Washington, DC 20005	www.atis.org (202) 628-6380
AWCMA	American Window Covering Manufacturers Assoc.	(Now WCMA)
AWI	Architectural Woodwork Institute P.O. Box 1550 13924 Braddock Rd., No. 100 Centerville, VA 22020	www.awinet.org (800) 449-8811 (703) 733-0600
AWPA	American Wood Preservers' Assoc. P.O. Box 286 Woodstock, MD 21163-0286	www.awpa.com (817) 326-6300
AWPB	American Wood Preservers' Bureau (This organization is now defunct.)	
AWS	American Welding Society 550 LeJeune Rd., NW Miami, FL 33126	www.aws.org (800) 443-9353 (305) 443-9353
AWWA	American Water Works Assoc. 6666 W. Quincy Ave. Denver, CO 80235	www.awwa.org (800) 926-7337 (303) 794-7711
BANC	Brick Association of North Carolina P.O. Box 13290 Greensboro, NC 27415-3290	 (910) 273-5566
BHMA	Builders Hardware Manufacturers Assoc. 355 Lexington Ave., 17th Floor New York, NY 10017-6603	www.buildershardware.com (212) 297-2122

BIA	Brick Institute of America 11490 Commerce Park Dr. Reston, VA 22091-1525	www.bia.org (703) 620-0010
BIFMA	The Business and Institutional Furniture Manufacturer's Association International 2680 Horizon Dr., SE, Suite A1 Grand Rapids, MI 49546-7500	www.bifma.com (616) 285-3963
CAGI	Compressed Air and Gas Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	www.cagi.org (216) 241-7333
CAUS	Color Association of the United States 315 West 39th Street, Studio 507 New York, NY 10018	www.colorassociation.com (212) 947-7774
CBM	Certified Ballast Manufacturers Assoc. 1422 Euclid Ave., Suite 402 Cleveland, OH 44115-2851	 (216) 241-0711
CCC	Carpet Cushion Council P.O. Box 546 Riverside, CT 06878	www.carpetcushion.org (203) 637-1312
CCFSS	Center for Cold-formed Steel Structures	www.umr.edu/~ccfss (573) 341-4471
CDA	Copper Development Association Inc. 260 Madison Av., 16th Floor New York, NY 10016	www.copper.org (212) 251-7200 (800) 232-3282
CFFA	Chemical Fabrics & Film Association, Inc. c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	www.chemicalfabricsandfilm.com (216) 241-7333
CGA	Compressed Gas Assoc. 1725 Jefferson Davis Highway, Suite 1004 Arlington, VA 22202-4100	www.cganet.com (703) 412-0900
CGSB	Canadian General Standards Board	www.pwgsc.gc.ca/cgsb (819) 956-0425
CIMA	Cellulose Insulation Manufacturers Association	www.cellulose.org (888) 881-2462
CISCA	Ceiling and Interior Systems Construction Assoc. 579 W. North Ave., Suite 301 Elmhurst, IL 60126	www.cisca.org (630) 584-1919
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Rd., Suite 419 Chattanooga, TN 37421	www.cispi.org (423) 892-0137

CLFMI	Chain Link Fence Manufacturers Institute 1776 Massachusetts Ave., NW, Suite 500 Washington, DC 20036	www.chainlinkinfo.org (301) 569-2583
CPA	Composite Panel Association (Formerly: National Particleboard Association)	www.pbmdf.com (301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association	www.cppa-info.org (800) 510-2772
CRI	Carpet and Rug Institute P.O. Box 2048 Dalton, GA 30722-2048	www.carpet-rug.com (800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758	www.crsi.org (847) 517-1200
CSA	CSA International (Formerly: IAS – International Approval Services)	www.csa-international.org (416) 747-4000
CSI	Construction Specifications Institute	www.csinet.org (800) 689-2900
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)	www.cti.org (281) 583-4087
CTIOA	Ceramic Tile Institute of America 12061 West Jefferson Blvd. Culver City, CA 90230 – 6219	www.ctia.org (310) 574-7800
DHI	Door and Hardware Institute 14170 Newbrook Dr. Chantilly, VA 22021-2223	www.dhi.org (703) 222-2010
DIPRA	Ductile Iron Pipe Research Assoc. 245 Riverchase Parkway East, Suite O Birmingham, AL 35244	www.dipra.com (205) 402-8700
DLPA	Decorative Laminate Products Assoc. 13924 Braddock Rd. Centreville, VA 22020	 (800) 684-3572
ECSA	Exchange Carriers Standards Assoc. (Now ATIS)	
EIA/TIA	Electronic Industries Alliance/Telecommunications Industry 2001 Pennsylvania Ave., NW Washington, DC 20006-1813	www.eia.org (703) 907-7500
EIMA	EIFS Industry Manufacturers Assoc. 2759 State Road 580, Suite 112 Clearwater, FL 34621	www.eifsfacts.com (800) 294-3462 (770) 968-7945
EJMA	Expansion Joint Manufacturers Assoc. 25 N. Broadway	www.ejma.org

	Tarrytown, NY 10591	(914) 332-0040
ETL	ETL SEMKO Testing Laboratories, Inc. 420 North Dorothy Drive Richardson, Texas 75081	www.etlsemko.com (972) 238-5591
FCI	Fluid Controls Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	www.fluidcontrolsinstitute.org (216) 241-7333
FCICA	Floor Covering Installation Contractors Assoc. (Formerly Floor Covering Installation Board) P.O. Box 948 Dalton, GA 30722-0948	 (706) 226-5488
FGMA	Flat Glass Marketing Assoc. (Now GANA)	
FM	Factory Mutual 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, MA 02062	(See FMG) (617) 762-4300
FMG	FM Global (Formerly: FM – Factory Mutual System)	www.fmglobal.com (401) 275-3000
FTI	Facing Tile Institute P.O. Box 8880 Canton, OH 44711	 (216) 488-1211
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002	www.gypsum.org (202) 289-5440
GANA	Glass Association of North America (Formerly: FGMA – Flat glass Marketing Association) 3310 SW Harrison St. Topeka, KS 66611-2279	www.glasswebsite.com/gana (785) 271-0208
GRI	Geosynthetic Research Institute	www.drexel.edu/gana (215) 895-2343
GTA	Glass Tempering Division of Glass Association of North America	(See GANA)
HEI	Heat Exchange Institute 1300 Sumner Ave. Cleveland, OH 44115-2851	www.heatexchange.org (216) 241-7333
HI	Hydraulic Institute 9 Sylvan Way Parsippany, NJ 07054-3802	www.pumps.org (888) 786-7744 (973) 267-9700
HI	Hydronics Institute P.O. Box 218 35 Russo Place	www.gamanet.org

	Berkeley Heights, NJ 07922	(908) 464-8200
HMA	Hardwood Manufacturers Assoc. 400 Penn Center Blvd. Pittsburgh, PA 15235	www.hardwood.org (412) 829-0770
HPVA	Hardwood Plywood and Veneer Assoc. 1825 Michael Farraday Dr. P.O. Box 2789 Reston, VA 22090-0789	www.hpva.org (703) 435-2900
HPW	H.P. White Laboratory, Inc.	www.hpwhite.com (410) 838-6550
IBD	Institute of Business Designers 341 Merchandise Mart Chicago, IL 60654	(312) 467-1950
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 440 South Yarmouth, MA 02664	www.icea.net (508) 394-4424
ICRI	International Concrete Repair Institute (The)	www.icri.org (703) 450-0116
IEC	International Electrotechnical Commission (Available from ANSI) 11 West 42nd St., 13th Floor New York, NY 10036	www.iec.ch 41-22-919-02-11 (212) 642-4900
IEEE	Institute of Electrical and Electronic Engineers 345 E. 47th St. New York, NY 10017	www.ieee.org (212) 419-7900
IESNA	Illuminating Engineering Society of North America 120 Wall St., Floor 17 New York, NY 10005-4001	www.iesna.org (212) 248-5000
IGCC	Insulating Glass Certification Council c/o ETL Testing Laboratories, Inc. P.O. Box 2040 Route 11, Industrial Park Cortland, NY 13045	www.igcc.org (315) 646-2234
ILI	Indiana Limestone Institute of America Stone City Bank Building, Suite 400 Bedford, IN 47421	www.iliai.com (812) 275-4426
IMSA	International Municipal Signal Assoc. 165 E. Union St. Newark, NY 14513 – 0539	www.imsafety.org (315) 331-2182
IRI	Industrial Risk Insurers P.O. Box 5010 85 Woodland St.	www.industrialrisk.com (800) 243-8308

	Hartford, CT 06102-5010	(860) 520-7300
ISA	Instrument Society of America P.O. Box 12277 67 Alexander Dr. Research Triangle Park, NC 27709	www.isa.org (919) 549-8411
ITS	Intertek Testing Services	www.itsglobal.com (800) 345-3851
KCMA	Kitchen Cabinet Manufacturers Assoc. 1899 Preston White Dr. Reston, VA 22091-4326	www.kcma.org (703) 264-1690
LGSI	Light Gage Structural Institute P.O. Box 866301 Plano, TX 75086-6301	www.loseke.com (972) 370-0967
LIA	Lead Industries Association, Inc. 295 Madison Ave. New York, NY 10017	www.leadinfo.com (212) 578-4750
LMA	Laminating Materials Association (Formerly: ALA – American Laminators Association)	www.lma.org (201) 664-2700
LPI	Lightning Protection Institute 3365 N. Arlington Heights Rd., Suite J Arlington Heights, IL 60004	www.lightning.org (847) 577-7200 (800) 488-6864
LSGA	Laminated Safety Glass Association	(See GANA)
MBMA	Metal Building Manufacturer's Assoc. c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	www.mbma.com (216) 241-7333
MCA	Metal Construction Association	www.metalconstruction.org (312) 201-0193
MCAA	Mechanical Contractors Association of America 1385 Piccard Dr. Rockville, MD 20850-4329	www.mcaa.org (301) 869-5800
MFMA	Maple Flooring Manufacturers Assoc. 60 Revere Dr., Suite 500 Northbrook, IL 60062	www.maplefloor.org (847) 480-9138
MFMA	Metal Framing Manufacturers Association (312) 644-6610	www.sba.com
MGPHO	Medical Gas Professional Healthcare Organization, Inc	www.mgpho.org (877) 238-5157
MHIA	Material Handling Industry of America	www.mhia.org (800) 345-1815

MIA	Marble Institute of America 30 Eden Alley, Suite 201 Columbus, OH 43215	www.marble-institute.com (614) 228-6194
MIA	Masonry Institute of America 386 Beech Avenue, Suite #4 Tarrence, CA 90501	www.masonryinstitute.org (310) 328-4400
ML/SFA	Metal Lath/Steel Framing Assoc. (A Division of the NAAMM) 11 South LaSalle St., Suite 1400 Chicago, IL 60603	(See SSMA) (312) 201-0101
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602	www.mss-hq.com (703) 281-6613
NAA	Tree Care Industry Association (formerly National Arborist Assoc.) 3 Perimeter Road, Unit 1 Manchester, NH 03103	www.natlab.com (800) 733-2622
NAAMM	National Association of Architectural Metal Manufacturers 11 South LaSalle St., Suite 1400 Chicago, IL 60603	www.naamm.org (312) 332-0405
NAAMM	North American Association of Mirror Manufacturers	(See GANA)
NAIMA	North American Insulation Manufacturers Assoc. 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314	www.naima.org (703) 684-0084
NAMI	National Accreditaion and Management Institute, Inc.	(304) 258-5100
NAPA	National Asphalt Pavement Assoc. NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4413	www.hotmix.com (888) HOT-MIXX
NAPF	National Association of Plastic Fabricators (Now DLPA)	
NAPM	National Association of Photographic Manufacturers	(See PIMA)
NBGQA	National Building Granite Quarries Assoc., Inc. c/o Rock of Ages 369 N. State St. Concord, NH 03301	www.nbgqa.com (800) 557-2848 (603) 225-8397
NBHA	National Builders Hardware Assoc.	(Now DHI)
NCMA	National Concrete Masonry Assoc.	www.ncma.org

	2302 Horse Pen Rd. Herndon, VA 22071-3499	 (703) 713-1900
NCPI	National Clay Pipe Institute P.O. Box 759 253-80 Center St. Lake Geneva, WI 53147	www.ncpi.org (414) 248-9094
NCRPM	National Council on Radiation Protection and Measurements 7910 Woodmont Ave., Suite 400 Bethesda, MD 20814 - 3095	www.ncrp.com (301) 657-2652
NCSPA	National Corrugated Steel Pipe Association 13140 Coit Road, Suite 320 LB120 Dallas, Texas 75240	www.ncspa.org (972) 850-1907
NCTA	National Cable Television Association	www.ncta.com (202) 775-3669
NEBB	National Environmental Balancing Bureau	www.nebb.org (301) 977-3698
NEC	National Electrical Code (Available from NFPA)	
NECA	National Electrical Contractors Assoc. 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-5372	www.necanet.org (301) 657-3110
NEII	National Elevator Industry, Inc. 1677 County Road 64 P.O. Box 838 Salem, New York 12865 - 0838	www.neii.org (518) 854-3100
NELMA	Northeastern Lumber Manufacturers Assoc. 272 Tuttle Rd. P.O. Box 87A Cumberland Center, ME 04021	www.nelma.org (207) 829-6901
NEMA	National Electrical Manufacturers Assoc. 2101 L St., NW, Suite 300 Washington, DC 20037	www.nema.org (703) 841-3200
NETA	International Electrical Testing Assoc. P.O. Box 687 Morrison, CO 80465-1526	www.netaworld.org (303) 697-8441
NFPA	National Fire Protection Assoc. One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101	www.nfpa.org (617) 770-3000 (800) 344-3555
NFPA	National Forest Products Assoc.	(Now AF&PA)
NFRC	National Fenestration Rating Council	www.nfrc.org (301) 589-6372

NGA	National Glass Association	www.glass.org (703) 442-4890
NHLA	National Hardwood Lumber Assoc. P.O. Box 34518 Memphis, TN 38184-0518	www.natlhardwood.org (800) 933-0318 (901) 377-1818
NKCA	National Kitchen Cabinet Assoc.	(Now KCMA)
NLGA	National Lumber Grades Authority 103-4400 Dominion St. Burnaby, BC V5G 4G3 CANADA	www.nlga.org (604) 524-2393
NOFMA	National Oak Flooring Manufacturers Assoc. P.O. Box 3009 Memphis, TN 38173-0009	www.nofma.org (901) 526-5016
NPA	National Particleboard Assoc. 18928 Premiere Ct. Gaithersburg, MD 20879-1569	(See CPA) (301) 670-0604
NPCA	National Paint and Coatings Assoc. 1500 Rhode Island Ave., NW Washington, DC 20005	www.paint.org (202) 462-6272
NRCA	National Roofing Contractors Assoc. O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607	www.nrca.net (800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association	www.nrmca.org (888) 846-7622
NSA	National Stone Association	www.aggregates.org (800) 342-1415
NSF	NSF International (Formerly National Sanitation Foundation) 3475 Plymouth Rd. Ann Arbor, MI 48113-0140	www.nsf.org (800) 673-6275
NSSEA	National School Supply and Equipment Assoc. Assoc. 8300 Colesville Rd., Stc. 250 Silver Spring, MD 20910	(734) 769-8010 (301) 495-0240
NTMA	National Terrazzo and Mosaic Assoc. 3166 Des Plaines Ave., Suite 132 Des Plaines, IL 60018	www.ntma.com (800) 323-9736
NWMA	National Woodwork Manufacturers Assoc.	(Now NWWDA) (703) 779-1022
NWWDA	National Wood Window and Door Assoc. 1400 E. Touhy Ave., #G54	(See WCMA) (708) 299-5200

	Des Plaines, IL 60018	(800) 223-2301
PATMI	Power Actuated Tool Manufacturers' Institute, Inc. 1603 Boone's Lick Road St. Charles, MO 63301	www.patmi.org (636) 947-6610
PCA	Portland Cement Assoc. 5420 Old Orchard Rd. Skokie, IL 60077-1083	www.portcement.org (847) 966-6200
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604	www.pci.org (312) 786-0300
PDCA	Painting and Decorating Contractors of America	www.pdca.com (800) 332-7322
PDI	Plumbing and Drainage Institute c/o Sol Baker 1106 W. 77th St., South Dr. Indianapolis, IN 46260	www.pdionline.org (800) 589-8956 (508) 230-3516
PEI	Porcelain Enamel Institute 3700 Mansell Road, Suite 220 Alpharetta, Georgia 30022	www.porcelainenamel.com (770) 281-8980
PGI	PVC Geomembrane Institute 205 North Mathews Avenue Urbana, Illinois 61801	//pgi-tp.ce.uiuc.edu (217) 333-3929
PIMA	Photographic & Imaging Manufacturers Association (Formerly: NAPM – National association of Photographic Manufacturers)	www.pima.net (914) 698-7603
PIMA	Polyisocyanurate Insulation Manufacturers Association 515 King Street, Suite 420 Alexandria, Virginia 22314	www.pima.org (703) 684-1136
RCSC	Research Council on Structural Connections	www.boltcouncil.org (800) 644-2400
RFCI	Resilient Floor Covering Institute 401 East Jefferson Street, Suite 102 Rockville, MD 20850	www.rfci.com (301) 340-8580
RIS	Redwood Inspection Service 405 Enfrente Dr., Suite 200 Novato, CA 94949	www.calredwood.org (415) 382-0662
RMA	Rubber Manufacturers Assoc. 1400 K St., NW Washington, DC 20005	www.rma.org (800) 220-7620 (202) 682-4800
SAE	SAE International	www.sae.org

	400 Commonwealth Dr. Warrendale, PA 15096-0001	(724) 776-4841
SDI	Steel Deck Institute P.O. Box 9506 Canton, OH 44711	www.sdi.org (847) 462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967	www.steeldoor.org (440) 889-0010
SEFA	Scientific Equipment and Furniture Assoc. 1028 Duchess Dr. McLean, VA 22102	www.sefalabfurn.com (843) 689-6878
SGCC	Safety Glazing Certification Council c/o ETL Testing Laboratories U.S. Route 11, Industrial Park Cortland, NY 13045	www.sgcc.org (315) 646-2234
SHLMA	Southern Hardwood Lumber Manufacturers Assoc. (Now HMA)	
SIGMA	Sealed Insulating Glass Manufacturers Assoc. 401 N. Michigan Ave. Chicago, IL 60611	www.sigmaonline.org/aigma (312) 644-6610
SJI	Steel Joist Institute 1205 48th Avenue North, Suite A Myrtle Beach, SC 29577-5424	www.steeljoist.org (803) 449-0487
SMA	Screen Manufacturers Assoc. 2850 South Ocean Boulevard, #114 Palm Beach, Florida 33480 - 6205	www.smacentral.org (561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Assoc. 4201 Lafayette Center Dr. Chantilly, VA 22022-1230	www.smacna.org (703) 803-2980
SPFA	Spray Polyurethane Foam Alliance	www.sprayfoam.org (800) 523-6154
SPI	The Society of the Plastics Industry	www.plasticsindustry.org ((202) 974-5200
SPIB	Southern Pine Inspection Bureau 4709 Scenic Highway Pensacola, FL 32504-9094	www.spib.org (850) 434-2611
SPRI	SPRI (Formerly Single Ply Roofing Institute) 175 Highland Ave. Needham, MA 02194	www.spri.org (781) 444-0242

SSIUS	Specialty Steel Industry of North America 3050 K St., NW Washington, DC 20007	www.ssina.com (800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA – Metal Lath/Steel Framing Association)	www.ssma.com (312) 456-5590
SSPC	SSCP: The Society for Protective Coatings	www.sspc.org (800) 837-8303
SSPC	Steel Structures Painting Council (The Society for Protective Coatings) 40 24th Street, 6th Floor Pittsburgh, PA 15222 - 4656	www.sspc.org (412) 281-2331
SSPMA	Sump and Sewage Pump Manufacturers Assoc. P.O. Box 647 Northbrook, IL 60065-0647	www.sspma.org (708) 559-9233
STI	Steel Tank Institute 570 Oakwood Rd. Lake Zurich, IL 60047	www.steeltank.com (847) 438-8265
SWI	Steel Window Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851	www.steelwindows.com (216) 241-7333
SWPA	Submersible Wastewater Pump Assoc. 1866 Sheridan Road, Suite 201 Highland Park, IL 60035-2545	www.swpa.org (847) 681-1868
SWRI	Sealant, Waterproofing, and Restoration Institute	www.swrionline.org (816)472-7974
TCA	Tile Council of America 511 Westinghouse Rd. Pendleton, SC 29670 P.O. Box 1787 Clemson, SC 29633	www.tileusa.com (864) 646-8453
TIA/EIA	Telecommunications Industry Association/ Electronic Industries Alliance	www.tiaonline.org (703) 907-7700
TIMA	Thermal Insulation Manufacturers Assoc. (Now NAIMA)	
TPI	Truss Plate Institute 583 D'Onofrio Dr., Suite 200 Madison, WI 53719	www.tpinst.org (608) 833-5900
TPI	Turfgrass Producers International (Formerly American Sod Producers Assoc.) 1855-A Hicks Rd. Rolling Meadows, IL 60008	www.turfgrasssod.org (847) 705-9898 (800) 405-8873

UFAC	Upholstered Furniture Action Council	www.ufac.org (336) 885-5065
UL	Underwriters Laboratories 333 Pfingsten Rd. Northbrook, IL 60062-2096	www.ul.com (800) 704-4050 (847) 272-8800
UNI	Uni-Bel PVC Pipe Assoc. 2655 Villa Creek Dr., Suite 155 Dallas, TX 75234	www.uni-bell.org (972) 243-3902
USITT	United States Institute for Theatre Technology, Inc.	www.culturenet.ca/usitt (800) 938-7488
USP	U.S. Pharmacopeia (Formerly U.S. Pharmacopoeial Convention) 12601 Twinbrook Pkwy Rockville, MD 20852	www.usp.org (800) 822-8772 (301) 881-0666
WA	Wallcoverings Assoc. 401 N. Michigan Ave. Chicago, IL 60611-4267	www.wallcoverings.org (312) 644-6618
WASTEC	Waste Equipment Technology Association	www.wastec.org (800) 424-2869
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281	www.wclib.org (800) 283-1486 (503) 639-0651
WCMA	Wood Components Manufacturer's Association 1000 Johnson Ferry Road, Suite A-130 Marrietta, Georgia 30068	www.woodcomponents.org (770) 565-6660
WCMA	Window Covering Manufacturers Assoc. 355 Lexington Ave., 17th Floor New York, NY 10017	www.windowcoverings.org (800) 506-4653 (212) 661-4261
WIC	Woodwork Institute of California 3164 Industrial Blvd. P.O. Box 980247 West Sacramento, CA 95798-0247	www.wicnet.org (916) 372-9943
WMMPA	Wood Molding & Millwork Producers Assoc. P.O. Box 25278 Portland, OR 97225	www.wmmpa.com (800)550-7889 (530) 661-9591
WRI	Wire Reinforcement Institute 942 Main Street, Suite 300 Hartford, CT 06103	www.wirereinforcementinstitute.org (800) 552-4974
WSC	Water Systems Council 1101 30th Street N.W., Suite 500 Washington, D.C. 20007	www.watersystemscouncil.org (202) 625-4387
WSFI	Wood and Synthetic Flooring Institute (Now MFMA)	

WWCCA	Western Wall and Ceiling Contractors' Assoc. (Formerly Western Lath, Plaster, Drywall Industries Assoc.) 2286 North State College Boulevard Fullerton, CA 92831	www.wwcca.org (800) 903-WALL
WWPA	Western Wood Products Assoc. Yeon Building 522 SW 5th Ave. Portland, OR 97204-2122	www.wwpa.org (503) 224-3930
WWPA	Woven Wire Products Assoc. 1641 East Higgins Lake Drive Roscommon, MI 48653	www.wovenwire.org (517) 821-6621

H. Federal Government Agencies: Names and titles of Federal Government standards- or specification-producing agencies are often abbreviated. The following abbreviations and acronyms referenced in the Contract Documents indicate names of standards- or specification-producing agencies of the Federal Government. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

CE	Corps of Engineers (U.S. Department of the Army) Chief of Engineers General Information Referral 20 Massachusetts Ave., NW Washington, DC 20314	www.usace.army.mil (202) 761-0660
CFR	Code of Federal Regulations (Available from the Government Printing Office) 732 N. Capitol St., NW Washington, DC 20401 (Material is usually published first in the "Federal Register.")	www.gpoaccess.gov (202) 512-0000
CPSC	Consumer Product Safety Commission East West Towers 4330 East-West Hwy Bethesda, MD 20814	www.cpsc.gov (800) 638-2772
CS	Commercial Standard www.commerce.gov (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	 (202) 512-0000
DOC	Department of Commerce 14th St. and Constitution Ave., NW Washington, DC 20230	www.doc.gov (202) 482-2000
DOT	Department of Transportation 400 Seventh St., SW Washington, DC 20590	www.dot.gov (202) 366-4000
EPA	Environmental Protection Agency	www.epa.gov

	401 M St., SW Washington, DC 20460	(202) 260-2090
FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20591	www.faa.gov (202) 366-4000
FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554	www.fcc.gov (202) 418-0190
FDA	Food and Drug Administration 5600 Fishers Lane Rockville, MD 20857 (888) 463-6332	www.fda.gov
FHA	Federal Housing Administration (U.S. Department of Housing and Urban Development) 451 Seventh St., SW Washington, DC 20410	www.hud.gov (202) 708-1112
FS	Federal Specification Unit (Available from GSA) 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407	(202) 755-0325
GSA	General Services Administration F St. and 18th St., NW Washington, DC 20405	www.gsa.gov (202) 708-5082
HUD	Department of Housing and Urban Development	www.hud.gov (202) 708-1112
LBNL	Lawrence Berkeley National Laboratory	www.lbl.gov (510) 486-5605
MIL	Military Standardization Documents (U.S. Department of Defense) Defense Printing Service 700 Robbins Ave., Building 4D Philadelphia, PA 19111	(215) 697-2179
NIST	National Institute of Standards and Technology (U.S. Department of Commerce) Building 101, #A1134 Rte. I-270 and Quince Orchard Rd. Gaithersburg, MD 20899	www.nist.gov (301) 975-6478
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) 200 Constitution Ave., NW Washington, DC 20210	www.osha.gov (202) 693-1999

PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	www.commerce.gov (202) 512-0000
RUS	Rural Utilities Service (See USDA) (Formerly Rural Electrification Administration) (U.S. Department of Agriculture) 14th St. and Independence Ave., SW Washington, DC 20250	 (202) 720-9560
TRB	Transportation Research Board	www.nas.edu/trb (202) 334-2934
USDA	U.S. Department of Agriculture 14th St. and Independence Ave., SW Washington, DC 20250	www.usda.gov (202) 720-2791
USPS	U.S. Postal Service www.usps.com 475 L'Enfant Plaza, SW Washington, DC 20260-0010	 (202) 268-2000

I. GOVERNING REGULATIONS/AUTHORITIES

1. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

1.5 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY

A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

B. Temporary utilities which may be required include but are not limited to:

1. Water service and distribution.
2. Temporary electric power and light.
3. Telephone service.
4. Storm and sanitary sewer.

C. Temporary construction and support facilities which may be required include but are not limited to:

1. Temporary heat.
2. Storage sheds.
3. Sanitary facilities, including drinking water.
4. Dewatering facilities and drains.
5. Temporary enclosures.
6. Hoists.
7. Temporary Project identification signs and bulletin boards.
8. Waste disposal services.
9. Rodent and pest control.
10. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities which may be required include but are not limited to:

1. Temporary fire protection.
2. Barricades, warning signs, lights.
3. Sidewalk bridge or enclosure fence for the site.
4. Environmental protection.

1.3 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.

B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and

Demolition", and NECA Electrical Design Library, "Temporary Electrical Facilities."

1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.

C. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).

D. Inspections: For inspections and tests of temporary facilities required by authorities having jurisdiction, arrange for such inspections or tests before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. Temporary Utilities: Inform the Owner of scheduled dates for termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.

B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.

2.2 EQUIPMENT

A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.

B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.

C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.

D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.

E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.

F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

G. Temporary Offices: Provide prefabricated or mobile units with lockable entrances, operable windows and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.

H. Temporary Storage Sheds: Provide prefabricated or mobile units with lockable entrances. Provide heated units on foundations adequate for normal loading.

I. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.

J. First Aid Supplies: Comply with governing regulations.

K. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.

1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.

1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

B. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be accepted as a basis of claims for a Change Order.

C. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.

1. Sterilization: Sterilize temporary water piping prior to use.

D. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
   1. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, AC 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

E. Temporary Lighting: Wherever overhead floor or roof deck has been installed, provide temporary lighting with local switching.

   1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.

F. Temporary Telephones: Provide temporary telephone service for use by all personnel engaged in construction activities. Where field offices are required, provide temporary telephone service consisting of a minimum of two separate telephone lines (one line dedicated for facsimile machine) in the field office for use by personnel engaged in construction activities throughout the construction period. Provide internet access for email in the field office.

G. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.

   1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
   2. Connect temporary sewers to the municipal system as directed by the sewer department officials.
   3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
   4. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

A. If required for completion of the Work, locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
   1. Maintain temporary construction and support facilities until Final Completion. Remove prior to final application for payment. Where temporary construction or facilities interfere with the Owner’s use or occupation of the Work after Substantial Completion, remove, relocate, or modify temporary construction and facilities as required to permit Owner’s use and occupancy.

B. Provide incombustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.

C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

D. Heating Facilities: Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.

E. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows:
1. Furnish with at least two desks and chairs, a 4-drawer file cabinet, plan table and plan rack, a 6-shelf bookcase, conference table and chairs, modem with wireless internet access, and printer.
2. Provide an office for the Owner/Architect’s use while on site including desk and chair. Architect may utilize phone, fax, printer, and internet for work related to this Project.
3. All samples will be stored in the Field Office for easy access.

F. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service.

G. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best service the Project's needs.

1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

H. Drinking Water Fixtures: Provide drinking water fountains where required to for compliance with regulations and health codes, including paper supply.

I. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division-2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.

J. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
1. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.

K. Temporary Lifts and Hoists: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

L. Project Identification and Temporary Signs: Display no signs without approval of the Architect. Do not permit installation of unauthorized signs.

1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with the following drawings.
2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.

M. Temporary Exterior Lighting: Install exterior yard and sign lights so that signs are visible when Work is being performed.

N. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

O. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.

B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.

E. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except by the entrance gates.

1. Provide open-mesh, chain-link fencing with posts set in compacted earth.

F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

G. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.

C. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

D. Termination and Removal: Remove each temporary facility when the need has ended, or when 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 the 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 the Contractor. The Owner reserves the right to take possession of Project identification signs.

2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt or other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street paving, curbs and sidewalks at the temporary entrances and elsewhere when used during construction, as required by the governing

authority, Architect and or the Owner.

3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
   a. Replace air filters.
   b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
   c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION

SECTION 01 55 13.10 - STABILIZED CONSTRUCTION ACCESS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Installation of erosion and sediment control for stabilized construction access points used during construction and until final development of the site.

1.2 SUBMITTALS

A. Manufacturer's catalog sheets and other product data on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Specification.

1.3 REFERENCES

A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 P R O D U C T S

2.1 GEOTEXTILE FABRIC

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632), and the equivalent opening size between 50 and 140.

C. Both the geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable life at a temperature range of 0°F to 120°F.

D. Representative Manufacturers: Mirafi, Inc., or equal.

2.2 COARSE AGGREGATES

A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall be 2" to 5" in size. No crushed concrete will be allowed.

PART 3 E X E C U T I O N

3.1 PREPARATION AND INSTALLATION

A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, Contractor shall provide stabilized construction roads and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than as specifically directed by the Owner's Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Owner's Representative to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction access points. Unless otherwise directed, maintain the stabilized construction roads and access points until the project is accepted by the Owner. Remove stabilized construction roads and access points promptly when directed by the Owner's Representative. Discard removed materials off site in accordance with the requirements of Division 1.

E. Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil site is not designated on the Drawings, dispose of sediment off site at location not in or adjacent to a stream or floodplain. Off-site disposal is the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into a stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state, and local rules and regulations.

F. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

G. Conduct all construction operation under this Contract in conformance with the erosion control practices described in Division 1.

3.2 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits, and truck washing areas when approved by Owner's Representative, of the sizes and locations where shown on Drawings or as specified in this Section.

C. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas which drain into a drainage system protected by erosion and sediment control measures.

D. Details for stabilized construction access points are shown on the Drawings. Construction of all other stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential.

E. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

F. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out

damaged control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

G. The length of the stabilized area shall be as shown on the Drawings, but not less than 50 feet. The thickness shall not be less than 8 inches. The width shall not be less than the full width of all points of ingress or regress.

H. Stabilization for other areas shall have the same coarse aggregate, thickness, and width requirements as the stabilized construction access points, except where shown otherwise on the Drawings.

I. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Owner's Representative.

J. Alternative methods of construction may be utilized when shown on Drawings, or when approved by the Owner's Representative. These methods include the following:
   1. Cement-Stabilized Soil - Compacted cement-stabilized soil or other fill material in an application thickness of at least 8 inches.
   2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.
   3. Steel Mats - Perforated mats placed across perpendicular support members.

END OF SECTION

SECTION 01 55 26 - TRAFFIC CONTROL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.

B. Qualifications and requirements for use of flagmen.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD).

B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Traffic control plan:
1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
2. If using a different traffic control plan, submit the plan for approval to the local Governing Jurisdiction, Owner and Engineer. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer. The Contractor is responsible for obtaining approval from the Governing entity if using an alternate plan.

C. Submit copies of approved lane closure permits issued by all governmental authorities.

D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.

E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.

1.5 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.

B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.
1. Uniformed Peace Officers may be:
a. Sheriffs and their deputies;
b. Constables and deputy constables;
c. Marshals or police officers of an incorporated city, town or village; or
d. As otherwise provided by Article 2.12, Code of Criminal Procedure.

2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.

C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:
1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center.
2. Speaks English. Ability to speak Spanish is desirable but not required.
3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City of Houston's Wage Scale for Engineering Construction.

D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 P R O D U C T S

2.1 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

2.2 PORTABLE LOW PROFILE CONCRETE BARRIERS

A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 E X E C U T I O N

3.1 PUBLIC ROADS

A. Submit requests forms for lane closure and sidewalk closure to the appropriate governmental authority at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits.

B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Owner's Representative.

C. Give Owner's Representative one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.

D. Notify police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.

E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.

F. Do not to obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Owner's Representative.

G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Owner's Representative to maintain temporary driveway access to commercial and residential driveways.

H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.

I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.

J. Provide safe access for pedestrians along major cross streets.

K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.

L. Do not close more than two consecutive esplanade openings at a time without prior approval from Owner's Representative.

3.2 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.3 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.4 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.5 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the governmental agency having jurisdiction a minimum of 60 days in advance of need for control boxes and switchgear. The Contractor will pay for all necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Owner's Representative, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.

E. Replace existing traffic control devices in Project area.

F. Owner's Representative may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the Owner.

3.6 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.

B. Shore trench or excavation to support bridge and traffic.

C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
1. Bridging is placed over existing bus routes,
2. More than five percent of daily traffic is comprised of commercial or truck traffic,
3. More than two separate plates are used for bridging, and
4. When bridge is to be used for more than five consecutive days.

D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.7 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.8 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:
1. Multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
2. Vehicular traffic must change lanes abruptly,
3. Construction equipment must enter or cross vehicular traffic lanes and walks,
4. Construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,
5. Traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
6. Where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.9 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Owner's Representative. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Owner's Representative for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Owner's Representative. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Owner's Representative. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Owner's Representative to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION

SECTION 01 57 10 - TPDES REQUIREMENTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 (the Construction General Permit).

B. Implementation, maintenance, inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.

C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with the Owner's Representative prior to start of construction.

1.2 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity: Project that:
1. Disturbs five acres or more, or
2. Disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.

C. Small Construction Activity: Project that:
1. Disturbs one or more acres but less than five acres, or
2. Disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.

D. TPDES Operator:
1. The person or persons who have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Prepare a SWP3 following Part III of the Construction General Permit and the applicable local code. If conflicts exist between the Construction General Permit and the local regulations, the more stringent requirements will apply.

B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.

C. Submit the SWP3 and any updates or revisions to the Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.

3.2 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

A. Fill out, sign, and date TCEQ Form 20022 Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000). Contractor shall provide NOI forms for both himself and Owner.

B. Transmit the signed Contractor's copy of TCEQ Form 20022, along with a check for the required fee, made out to Texas Commission on Environmental Quality.

C. Submission of the Notice of Intent form by the Contractor to TCEQ is required a minimum of fourteen days before Commencement of Construction Activities.

3.3 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR 150000, "Construction Site Notice."

B. Transmit the signed Construction Site Notice to the Engineer and Owner at least seven days prior to Commencement of Construction Activity.

3.4 CERTIFICATION REQUIREMENTS

A. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the EPA NPDES Construction Inspection Form.

3.5 RETENTION OF RECORDS

A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to the Owner's Representative.

3.6 REQUIRED NOTICES

A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:
   1. Post the TPDES permit number for Large Construction Activity or a signed TCEQ Construction Site Notice for Small Construction Activity. A signed copy of the Contractor's NOI must also be posted.
   2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
      a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with the Owner's Representative to conform to requirements of the Construction General Permit.
      b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
   3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.
   4. Post a notice of waste disposal procedures in a readily visible location on site.

3.7 ON-SITE WASTE MATERIAL STORAGE

A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

B. Prepare list of waste material to be stored on-site. Update list as necessary to include up to-date information. Keep a copy of updated list with the SWP3.

C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.8 NOTICE OF TERMINATION

A. Submit a NOT to TCEQ and the Engineer within 30 days after:
   1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
   2. Another operator has assumed control over all areas of the site that have not been stabilized; and
   3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.

END OF SECTION

SECTION 01 57 19 – TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising floodwaters.

C. Trapping suspended sediment in the discharge form the surface and ground water control systems.

PART 2 MEASUREMENT AND PAYMENT

2.1 UNIT PRICES

A. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated Price.

2.2 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3).

B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

C. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

2.3 DEFINITIONS

A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.
   1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.
   2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage: includes keeping excavations free of surface and seepage water.

C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.

D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

2.4 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.

B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Division 2 to produce following results:
   1. Effectively reduce hydrostatic pressure affecting:
      a. Excavations.
      b. Tunnel excavation, face stability or seepage into tunnels.
   2. Develop substantially dry and stable subgrade for subsequent construction operations.
   3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work.
   4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata.
   5. Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.

H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.

I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

2.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit Ground Water and Surface Water Control Plan for review by Owner’s Representative prior to start of excavation work. Include the following:
   1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control.
   2. Names of equipment Suppliers and installation Subcontractors.
   3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures.

4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.
5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
7. Operating requirements, including piezometric control elevations for dewatering and depressurization.
8. Excavation drainage methods including typical drainage layers, sump pump application and other means.
9. Surface water control and drainage installations.
10. Proposed methods and locations for disposing of removed water.

C. Submit following records upon completion of initial installation:
1. Installation and development reports for well points, eductors, and deep wells.
2. Installation reports and baseline readings for piezometers and monitoring wells.
3. Baseline analytical test data of water from monitoring wells.
4. Initial flow rates.

D. Submit the following records weekly during control of ground and surface water operations:
1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells.

2.6 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.

D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 3 P R O D U C T S

3.1 EQUIPMENT AND MATERIALS

A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Owner’s Representative through submittals required in Paragraph 1.06, Submittals.

B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed.

C. Maintain equipment in good repair and operating condition.

D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
   1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 4 E X E C U T I O N

4.1 GROUND WATER CONTROL

A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan submittal.

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.

D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.

F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.

G. Removal of ground water control installations.
   1. Remove pumping system components and piping when ground water control is no longer required.
   2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
   3. Remove monitoring wells when directed by Owner's Representative.
   4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.

I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.

J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.

K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.

M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

4.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For above ground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.

B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.

C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.

D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.6B.

4.3 SEDIMENT TRAPS

A. Install sediment tank as shown on approved plan.

B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

4.4 SEDIMENT SUMP PIT

A. Install sediment sump pits as shown on approved plan.

B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.

C. Extend standpipe 12 inches to 18 inches above lip of pit.

D. Convey discharge of water pumped from standpipe to sediment trapping device.

E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

4.5 EXCAVATION DRAINAGE

A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

4.6 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations.

D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Owner’s Representative.

4.7 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also, monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Owner’s Representative determines more frequent monitoring and recording are required. Comply with Owner’s Representative's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

4.8 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION

SECTION 01 57 23 – TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Division 1.

B. Installation and maintenance of storm-water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.

C. Filter Fabric Fences:
1. Type 1: Temporary filter fabric fences for erosion and sediment control in non-channelized flow areas.
2. Type 2: Temporary reinforced filter fabric fences for erosion and sediment control in channelized flow areas.

D. Straw Bale Fence.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCE STANDARDS

A. ASTM
1. A 36 - Standard Specification for Carbon Structural Steel.
2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft3 (600 kN-m/m3)].
3. D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.
4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

B. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.4 SYSTEM DESCRIPTIONS

A. Filter Fabric Fence Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Fences to remain in proper position and configuration at all times.

B. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.

C. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.

D. Sediment traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit manufacturer’s catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.

D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.

E. Submit shop drawings for Drop Inlet Baskets.

PART 2 P R O D U C T S

2.1 CONCRETE

A. Concrete: Class B in accordance with Division 32 or as shown on the Drawings.

2.2 AGREGATE MATERIALS

A. Use poorly graded cobbles with diameter greater than 2 inches and less than 5 inches.

B. Provide gravel lining in accordance with Division 31 or as shown on the drawings.

C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.

D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.3 PIPE

A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Division 33 or as shown on the Drawings.

B. Inlet Pipes: Galvanized steel pipe in accordance with Division 33 or as shown on the Drawings.

C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.4 GEOTEXTILE FILTER FABRIC

A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.

B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.

C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.

D. Mirafi, Inc., Synthetic Industries, or equivalent.

2.5 FENCING

A. Wire Fencing: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24 inch roll or sheet width of longest practical length.

B. Fence Stakes: Nominal 2 x 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 12 inch bury and full height of filter fabric.

2.6 SANDBAGS

A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
1. Minimum unit weight of four ounces per square yard.
2. Minimum grab strength of 100 psi in any principal direction (ASTM D4632).
3. Mullen burst strength exceeding 300 psi (ASTM D3786).
4. Ultraviolet stability exceeding 70 percent.
5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 50 to 125 pounds.

2.7 DROP INLET BASKET

A. Provide steel frame members in accordance with ASTM A36.

B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

PART 3 E X E C U T I O N

3.1 PREPARATION, INSTALLATION AND MAINTENANCE

A. Provide erosion and sediment control structures at locations shown on the Drawings.

B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manger to allow installation of erosion and sediment control systems, soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manger to remove and discard existing system.

D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. Re-dress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by Project Manger. Dispose of materials in accordance with Division 1.

E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Division 1.

F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Division 31.

G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.

H. Protect existing trees and plants in accordance with Division 1.

3.2 SEDIMENT TRAPS

A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.

B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.

C. Use fill material for embankment in accordance with Division 31.

D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.

E. Stone outlet sediment traps:
1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.
2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be a minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.

F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.

G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

3.3 FILTER FABRIC FENCE CONSTRUCTION METHODS

A. Fence Type 1
1. Install stakes 6 feet on center maximum and firmly embed minimum 12 inches in soil. If filter fabric is factory pre-assembled with support netting, then maximum support spacing is 8 feet. Install wood stakes at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench configuration as shown on Drawings may also be used.
3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
4. Staple filter fabric to stakes at maximum 3 inches on center. Extend fabric minimum 18 inches and maximum 36 inches above natural ground.
5. Backfill and compact trench.

B. Fence Type 2
1. Layout fence same as for Type 1.
2. Install stakes at 6 feet on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
3. Tie wire fence to stakes with wire at 6 inches on center maximum. Overlap joints minimum one bay of mesh.
4. Install trench same as for Type 1.
5. Fasten filter fabric wire fence with tie wires at 3 inches on center maximum.

6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
7. Backfill and compact trench.

C. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install stakes at a slight angle toward source of anticipated runoff.

D. Trench in toe of filter fabric fence with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

E. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

F. Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6 inch overlap and seal securely.

G. Triangular Filter Fabric Fence Construction Methods:
1. Attach filter fabric to wire fencing, 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter fence in place using one of the following methods:
   a. Toe-in skirt 6 inches with mechanically compacted material;
   b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
   c. Trench-in entire structure 4 inches.
3. Anchor triangular fabric filter fence structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6 inches to cover segment joints. Fasten joints with galvanized shoat rings.

H. Reinforced Filter Fabric Barrier Construction Methods:
1. Attach woven wire fence to fence stakes.
2. Securely fasten filter fabric material to wire fence with tie wires.
3. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.
4. Remove sediment deposits when silt reaches depth one-third height of barrier or 6 inches, whichever is less.

3.4 DIKE AND SWALE

A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.

B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.

C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as

shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.

D. Clear in accordance with Division 31.

E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

3.5 DOWN SPOUT EXTENDER

A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Division 33.

3.6 PIPE SLOPE DRAIN

A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.

B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.

C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.

D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.

E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

3.7 PAVED FLUME

A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.

B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.

C. Construct permanent paved flumes in accordance with Drawings.

D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.8 LEVEL SPREADER

A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.

B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.9 INLET PROTECTION BARRIER

A. Place sandbags and filter fabric fences at locations shown on the SWP3.

3.10 DROP INLET BASKET CONSTRUCTION METHODS.

A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.

B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.

C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.

D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 BRUSH BERM CONSTRUCTION METHODS

A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.

B. Use woody brush and branches having diameter less than 2-inches with 6-inches overlap. Avoid incorporation of annual weeds and soil into brush berm.

C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches minimum and side slopes shall be 2:1 or flatter.

D. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.12 STREET AND SIDEWALK CLEANING

A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Division 1.

B. In addition to stabilized construction access points, shovel or sweep pavements as required to keep areas clean. Do not water hose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.13 WASTE COLLECTION AREAS

A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.14 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.15 VEHICLE/ EQUIPMENT WASHING AREAS

A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Division 1. Install gravel or rock base beneath wash areas.

B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourses or storm water conveyance systems.

C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.16 WATER RUNOFF AND EROSION CONTROL

A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.

C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water to prevent flooding, erosion, or other damage to the site or adjoining areas. Follow environmental requirements.

E. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.

F. Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
   1. Hold area of bare soil exposed at one time to a minimum.
   2. Provide temporary controls such as berms, dikes, and drains.

G. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

H. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.

I. Dispose of sediments offsite, not in or adjacent to streams or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.

J. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8-inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.

K. Do not maneuver vehicles on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.

L. Do not damage existing trees intended to remain.

3.17 REMOVAL OF CONTROLS

A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Owner’s Representative.

B. Dispose of sediments and waste products following Division 1.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

1. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."
2. Since the Owner is a governmental entity or an organization which may be exempted from the sales and use taxes on certain tangible personal property, the Contractor shall be responsible for:
    a. Determining whether such governmental entity or organization is exempt from such taxes under the Contract Documents.
    b. Determining whether your purchase of any tangible personal property for use in the performance of this contract is exempt.
    c. Obtaining any sales tax exemption certificate from the Owner.
    d. Properly issuing any sales tax exemption certificate to a seller or supplier that the sale of any item of tangible personal property qualifies for an exemption. Maintaining any records required by the laws of the State of Texas or by any valid rules and/or regulations of the Comptroller of Public Accounts of the State of Texas.
    f. Payment of any legally assessed penalties or fines for improper use of any exemption Certificate.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

2. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

3. "Foreign Products", as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
4. "Materials" are products that are substantially shaped, cut, worked, mixed, finished,

refined or otherwise fabricated, processed, or installed to form a part of the Work.

5. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.4 SUBMITTALS

A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.

1. Coordinate the product list schedule with the Contractor's Construction Schedule and the Schedule of Submittals.

B. Form: Prepare the product listing schedule with information on each item tabulated under the following column headings:

1. Related Specification Section number.
2. Generic name used in Contract Documents.
3. Proprietary name, model number and similar designations.
4. Manufacturer's name and address.
5. Supplier's name and address.
6. Installer's name and address.
7. Projected delivery date, or time span of delivery period.

C. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

1. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.

D. Completed Schedule: Within 30 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

E. Architect's Action: The Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include the following:

1. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.5 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent

possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   1. Name of product and manufacturer.
   2. Model and serial number.
   3. Capacity.
   4. Speed.
   5. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.

B. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

C. 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.

D. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

E. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.

F. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

G. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

H. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 – PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents,

that are undamaged and, unless otherwise indicated, unused at the time of installation.

1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

B. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

C. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:

D. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.

E. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.

1. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

F. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning substitutions to obtain approval for use of an unnamed product.

G. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

H. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

I. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

J. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.

1. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning substitutions for selection of a matching product in another product category, or for noncompliance with specified requirements.

K. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and

manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

L. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division-1 for allowances that control product selection, and for procedures required for processing such selections.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.
2. Project record document submittal and digital archiving.
3. Operating and maintenance manual submittal and digital archiving.
4. Submittal of warranties.
5. Final cleaning.
6. Demonstration and training videotapes.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 26.

1.3 SUBSTANTIAL COMPLETION

A. To obtain Substantial Completion the following MUST be complete.
1. All HVAC Commissioning and Test & Balance issues resolved.
2. HVAC Controls Graphics complete and under the full control of Alvin ISD.
3. Elevator complete and being monitored by Alvin ISD Police.
4. Fire and Burglar Alarm Systems complete and being monitored by Alvin ISD.

B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
3. Advise Owner of pending insurance change-over requirements.
4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
5. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
6. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
7. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable. Extra materials include but are not necessarily limited to those listed in the “Summary of Extra Materials” following this Section.

8. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.
9. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate(s) of Substantial Completion following inspection(s) or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested, and assured by the Contractor in writing, that the Work has been substantially completed.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit Notice of Termination as required in Division 1 Section “Erosion and Sediment Control”.
7. Submit a final liquidated damages settlement statement.
8. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
9. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Re-inspection Procedure: The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of re-inspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, re-inspection will be repeated.
3. Should the Architect perform re-inspections, due to failure of the Work to comply with the claims of status of completion made by the Contractor, the Owner shall compensate the Architect for additional services; and the Owner shall deduct the amount of the compensation from the final payment to the Contractor.

1.5 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. **Record Drawings**: Maintain a clean, undamaged set of prints of Contract Drawings at the Project Site. This set must be updated as revisions or issued or field conditions change.

1. The Design Team will issue full revised sheets when changes are made.

2. The GC and Subcontractor's will note any field modifications on the final sheets in (red) prior to scanning the final drawings.

3. All drawings will include the words "As Built Record Drawings" in red located where the professional seals were removed by the GC.

4. The GC will digitally scan full size documents at 300 dpi, and provide a single bookmarked PDF in an editable file to the Owner and Architect for review within 90 days of Substantial completion. (Insure that pages are fit to screen prior to making bookmarks.)

5. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings. Example: field modifications.

6. Note related Proposal Requests (PR), Architect's Supplemental Instructions (ASI), Requests for Information (RFI), and Change Order (CO) numbers where applicable.

7. At completion of project, electronically transfer all Project Record Data to one complete set of PDF drawings.

8. Electronically remove, all professional seals on drawings.

9. Sheets with changes shall include the words 'RECORD DRAWINGS'. Where no changes are necessary on a sheet, add the phrase "NO CHANGES". These words shall be located where the professional seals were.

10. Make full size digital scans in indexed PDF format for all drawings and deliver to the Architect and Owner for review. Scans shall be a minimum 300 dpi and all items readable.

11. Bookmark the PDF file by discipline then by sheet. Ensure pages are "fit to screen" prior to making bookmarks. Example:

12. Submit Record Drawings to the Architect within 90 days of Substantial Completion. The Architect will make a cursory review of the drawings and mark any needed changes or additions and return to the Contractor. Do NOT provide prints for review.

13. Make any corrections and re-scan sheets as necessary. Print final half-size set and deliver the printed set and USB Flash Drive containing a single indexed digital file to the Owner. Deliver duplicate USB Flash Drive to the Architect.

    a. Include separate indexed USB Flash Drive to the Owner indicating locations of plumbing shutoff valves and electrical disconnects.

14. The costs of scanning and printing record drawings for review and final delivery shall be paid by the Contractor.

C. **Record Specifications**: Maintain at the project site one complete copy of the Project Manual, including addenda. Mark these specifications to show variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.

1. Upon completion of the Work, submit a hard-copy of the record Specifications to the Architect for review. Architect will make a cursory review of the record documents and mark any needed changes or additions to the hard-copy and return to the Contractor.

2. Make any corrections and scan specification pages. Reference “Document Scanning” below for scanning and delivery requirements.

3. The costs of scanning and printing record specifications for review and final delivery shall be paid by the Contractor.

D. **Record Project Data**: Make hard copies for binders including Change Orders, Proposal Requests and responses, Requests for Information and responses, and Architect’s Supplemental Instructions.

1. Submit one complete set of Record Project Data to the Architect for review. Architect will make a cursory review of the documents and mark any needed changes or additions to the hard-copy and return to the Contractor.

2. Make any corrections and digitally scan all Project Data pages. Deliver DVD containing a single indexed digital file to the Owner. Deliver duplicate DVD to the Architect. Reference “Document Scanning” below for scanning and delivery requirements.

3. The costs of scanning and printing record Project Data for review and final delivery shall be paid by the Contractor.

E. **Material Finishes Binder (if Applicable):** Provide Finishes Binder with physical samples of all finish materials included in completed Work. Group all samples according to Specification Section.

1. Samples shall include, but not be limited to Paint, Vinyl Wall Covering, Plastic Laminates, Carpet, Rubber Base, VCT, Wood Stains, and other Finishes and Color Selections, regardless of whether they are same as Color Schedule.
2. Label each sample with name of manufacturer, any product number, style or series, and color.
3. Make needed changes to Color Schedule and include in the Finishes Binder.
4. Where samples are or a size, material, or thickness that do not allow inclusion in the Finishes Binder (such as face brick or tile pavers), include product cut sheets from the manufacturer indicating manufacturer, any product number, style or series, and color.
5. Deliver completed Finishes Binder to Architect for review. Architect will make a cursory review of the Finishes Binder and mark any needed changes or additions and return to the Contractor.
6. Make any corrections and deliver completed binder to the Owner.
7. The costs of scanning, printing, and binding record Finishes pages for review and final delivery shall be paid by the Contractor.

F. **Operation and Maintenance Manuals**: Organize operating and maintenance data into

suitable sets of manageable size.

1. Provide (1) Binder Set and Deliver to Project Site.
2. Provide (1) single indexed digital PDF to owner via USB Flash Drive.
   a. Emergency instructions.
   b. Spare parts list.
   c. Copies of warranties.
   d. Wiring diagrams.
   e. Recommended "turn-around" cycles.
   f. Inspection procedures.
   g. Shop Drawings and Product Data.
   h. Fixture lamping schedule.

3. The GC will digitally scan all O&M documents at 300 dpi, and provide a single bookmarked PDF in an editable file to the Owner and Architect for review within 90 days of Substantial Completion. (Ensure that pages are fit to screen prior to making bookmarks.) (Delete any blank pages)
4. Once approved as complete, the GC will print and bind 1 set of Close Out documents in Heavy duty D Slat binders and deliver to the owner at the project site.
5. The costs of scanning, printing, and binding Maintenance and Operations information for review and final delivery shall be paid by the Contractor.

G. **Demonstration and Training Video:** Submit 1 copy of all demonstrations on (1) USB Flash Drive and deliver to owner within 90 days of substantial completion

1. Identification: label with the following information:
   a. Name of Project.
   b. Name and address of photographer.
   c. Name of Architect (and Construction Manager when applicable).
   d. Name of Contractor.
   e. Date video was recorded.
   f. Description of video content including description of subject building equipment and/ or systems, and general description of training or procedures covered.

2. GC may provide manufacturer’s standard video in lieu of on-site custom recorded video if first approved by the Owner.

H. **Close-Out Document Manuals:** Submit for review to the Architect one PDF file bookmarked and indexed in the proper order that the final Close-out binders will be. Do not print binders for the Architect’s review.

The GC will digitally scan all close out documents at 300 dpi, and provide a single bookmarked PDF in an editable file to the Owner and Architect for review within 90 days of Substantial Completion.(Insure that pages are fit to screen prior to making bookmarks.)

Once approved as complete, the GC will print and bind 1 set of Close Out documents in Heavy duty D Slat binders and deliver to the owner at the project site.

The Close Out PDF will include the following in this order (Omit anything not applicable);

1. Project Directory
2. Final List of Subcontractors / Suppliers with Contact information (AIA G805)
3. Contractor’s Affidavit of Payment & Debts Claim (AIA G706)
4. Contractor’s Affidavit of Release of Liens (AIA G706A)
5. Certificate of Substantial Completion (AIA G704)

6. Consent of Surety of Final Payment (AIA G707)
7. Contractor Conditional Waiver & Release of Final Payment
8. Subcontractor/Supplier Release of Final Payment
9. General Contractor Warranty
10. List of Subcontractors / Suppliers & Warranties by Division as cover page for individual subcontractor warranties
11. General Contractor's Hazardous Material Fee (Asbestos/PCBs/Lead) Certificate
12. Subcontractor Supplier Hazardous Material Fee (Asbestos/PCBs/Lead) Certificates
13. Architect / Engineer Hazardous Material Fee (Asbestos/PCBs/Lead) Certificates
14. Plumbing Subcontractor / Supplier (No Lead) Certificate
15. Mechanical Subcontractor / Supplier Refrigerant Certificate
16. Electrical Subcontractor / Supplier (No PCBs) Certificate
17. Materials Testing Letter of Compliance
18. Certificate of TEA Compliance
19. Building Envelope Letter of Compliance
20. Certificate of Occupancy
21. Structural Letter of Compliance
22. Elevation Certificates
23. Elevator Inspection & Acceptance
24. Windstorm WPI-8 Certificate
25. TCEQ Clearance Letter
26. MEP Letter of Compliance / Com Check
27. Plumber Valve Tag Index
28. Fire Alarm Installation Certificate
29. Stage Curtain Fire Certificate
30. TAS Acceptance Letter and State Certificate of Compliance
31. Well Permit
32. Kitchen Food Service Inspection / Permit
33. Boiler Inspection / Permit
34. Backflow Tests / Inspections
35. Key Sign Off to Owner
36. Key Bitting
37. Extra Stock Signoff to Owner
38. Demonstrations - Sign In.

I. **Document Scanning:** PDF files can be created by scans or source PDF files from drawings or other electronic documents.

1. Final documents shall be one digital file each for the following information indexed according to major and minor criteria as indicated below:
   a. Record Drawings organized and bookmarked by discipline then drawing number with title
   b. Record Specifications organized and bookmarked by Division then Specification number with name
   c. Record Product Data organized and bookmarked by specification section and

name
d. Operation and Maintenance Manuals organized and bookmarked by specification section and name
e. Closeout Manuals organized by contractor and/or subcontractor name and trade.
f. Include extended warranties page at beginning of warranty section.

2. Deliver 1 USB Flash Drive to the Owner and 1 to the Architect.

3. All documents shall be scanned at a minimum resolution of 300 dpi.

4. Submit proposed document table of contents to Architect for review prior to completion of scanning and bookmarking work.

5. OCR (searchable) PDF are NOT REQUIRED.

J. Release of Retainage
1. 3% Retainage will be released by owner when all punch list items have been verified as complete. The final 2% Retainage will be released by the owner when all required Close Out Documents have been verified complete by the Architect and provided to the owner.
a. The ARCHITECT and their consultants shall not approve substitution of products that deviate from those specified in this document without prior written approval from OWNER.
b. The Architect will provide an owner room number G sheet *(clean floor plan with only owner room numbers in text big enough to read when the sheet is reduced to 8-1/2" x11"). A separate floor plan with room square feet shall be included in the as-builts.*

PART 2 - PRODUCTS

2.1 CLEANING AGENTS: Use cleaning materials and agents recommended by the 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.

2.2 PHOTOGRAPHIC MEDIA

1. Video Format: Provide high-quality digital files that can be played on a PC (.wmv or similar).

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.

6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shut down.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.
8. Upon review and approval of Architect and Owner of close-out manuals, Contractor to send documents to reprographics company for scanning. Refer to Section H below for additional information concerning PDF scanning and bookmarking requirements. The cost of scanning and bookmarking close out manuals shall be paid by the Contractor.

C. Demonstration and Training Video: Record instruction of Owner's personnel in the operation and maintenance of equipment and systems. Edit video to remove non-instructional conversation. Photographer shall select vantage points to best show equipment, systems, and procedures demonstrated.

1. Contractor may, with Owner’s written approval and in compliance with other requirements, provide manufacturer’s standard demonstration and training video in lieu of on-site custom recorded video.

D. Attic Stock Materials Schedule: Provide a schedule of all attic stock materials. Include information pertaining to quality, description, manufacturer, model no., color, and finish.

3.2 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
2. Remove labels that are not permanent labels.
3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
4. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
5. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
6. Clean the site, including landscape development areas, of rubbish, litter and foreign

substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section also apply to mechanical and electrical installations, as well as work specified in Divisions 2 through 32. Refer to Division-23 and Division-26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
    a. Foundation construction.
    b. Bearing and retaining walls.
    c. Structural concrete.
    d. Structural steel.
    e. Lintels.

f. Structural decking.
g. Miscellaneous structural metals.
h. Equipment supports.
i. Piping, ductwork, vessels and equipment.
j. Structural systems of special construction in Division-13.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
   a. Shoring, bracing, and sheeting.
   b. Primary operational systems and equipment.
   c. Air or smoke barriers.
   d. Water, moisture, or vapor barriers.
   e. Membranes and flashings.
   f. Fire protection systems.
   g. Noise and vibration control elements and systems.
   h. Control systems.
   i. Communication systems.
   j. Conveying systems.
   k. Electrical wiring systems.
   l. Special construction specified by Division-13 Sections.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
   a. Matched-veneer woodwork.
   b. Preformed metal panels.
   c. Window wall system.
   d. Acoustical ceilings.
   e. Finished wood flooring.
   f. Carpeting.
   g. Aggregate wall coating.
   h. Wall covering.
   i. HVAC enclosures, cabinets or covers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

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

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
2. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
4. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
5. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01 74 16 - SITE MAINTENANCE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this section in total Stipulated Price.

1.3 DEFINITIONS

A. Phase: Locations identified on the plans and listed in Division 1.

B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.

C. Site Improvement: Includes pavement, curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.4 SCHEDULING

A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of work in an area.

B. Phased Construction:
1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Pavement, Sidewalks and Driveways: Materials specified in Division 32.

B. Seeding and Sodding: Sod specified in Division 32.

C. Trees, Shrubs and Plantings: Conform to requirements of Division 1.

PART 3 E X E C U T I O N

3.1 SITE PROJECTS

A. Contractor shall maintain a clean and orderly site throughout construction duration. Work includes but is not limited to: insuring grass is mowed and kept at a manageable height, trash is continuously picked up and construction materials are stored in an orderly fashion.

B. Contractor shall immediately repair and restore any damage done to adjoining properties such that final conditions are as equal to or better than prior to damage occurring.

3.2 WORK IN PUBLIC ROW

A. Contractor shall repair and replace any damaged items in the Public ROW to the satisfaction of the local governing authority.

3.3 CLEANING

A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Division 1.

3.4 LANDSCAPING AND FENCES

A. Seeding and Sodding.
   1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.
   2. Restore previously existing turfed areas with sod and fertilize in accordance with Division 32. Sod to match existing turf.
   3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Division 32.

B. Trees, Shrubbery and Plants.
   1. Remove and replant trees, shrubs, and plants in accordance with requirements of Division 1.

C. Fence Replacement.
   1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work, may be reused.
   2. Remove and dispose of damaged or substandard material.

3.5 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

B. Refer to Division 1 for maintenance requirements.

END OF SECTION

SECTION 01 74 19 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.2 SUBMITTALS

A. Conform to requirements of Division 1.

B. Contractor shall obtain all required permits prior to disposal of excess material in areas designated as being in "100-year Flood Hazard Area."

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP). Refer to Division 1.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.1 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into Owner's designated trucks.

C. Pipe Culvert: Load culverts designated for salvage into Owner's designated trucks.

D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

E. Coordinate loading of salvageable material on Owner's trucks with Owner's Representative.

F. The Contractor shall dispose of all items the Owner refuses in conformance with the requirements of Division 1 at no additional cost to the Owner.

3.2 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless a permit has been obtained. Remove excess material placed in "100-year Flood Hazard Area" without a permit, at no additional cost to the Owner.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION

SECTION 01 78 00 - WARRANTIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.
   1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
   2. Refer to Section 01 80 00 – Special Owner Requirements for procedures to be followed in correcting work under warranty.
   3. Closeout requirements are included in Section "Execution and Closeout Procedures."
   4. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 - 16.
   5. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

B. Separate Prime Contracts: Each Contractor responsible for warranties related to his Contract.

1.3 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

A. The General Contractor will be the first point of contact for warranty work performed by subcontractors and manufacturers. Refer to Section 01 80 00 – Special Owner Requirements for procedures to be followed in reporting and correcting work under warranty.

B. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation. The warranty period shall not be extended.

D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work, including the cost of equipment needed to perform the Work, regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service

life.

E. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
   1. Rejection of Warranties: Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
      a. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

A. Submit written warranties to the Architect prior to the date of activation. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
   1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the Work.
   2. When a special warranty is required, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
   3. Forms for special warranties are included at the end of particular Sections. Prepare a written document utilizing the appropriate form, ready for execution by the warrantor. Submit a draft to the Owner through the Architect for approval prior to final execution.
      a. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.

B. Form of Submittal: At Final Completion compile two copies of each required warranty properly executed. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
      a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
      b. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES”, the Project title or name, and the name of the Contractor.
   2. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not applicable).

PART 3 - EXECUTION (Not applicable).

END OF SECTION

Special Owner Requirements

CONTRACTOR'S INSTRUCTION MANUAL FOR ALVIN ISD Revised: January 7, 2023

This manual is provided to contractors who perform services for Alvin ISD. Responsibility for compliance and education of the contractor's staff, suppliers, and subcontractors is a contractual obligation of the individual or company with whom Alvin ISD has contracted to perform the work and services (hereafter referred to as contractor or prime contractor).

The contractor will be required to acknowledge receipt and understanding of this document prior to moving onto any Alvin ISD site or property and beginning work.

A. Contractor's Safety Program

The prime contractor will have a written safety program that is communicated and enforced with construction personnel during the course of performing the contract or services. An electronic copy of the program will be provided to AISD.

As part of the contractor's safety program education, the contractor will be responsible for and ensure that all construction workers, subcontractors, suppliers, etc are made aware of AISD's safety requirements and instructions as included herein.

B. General Requirements

1. All construction related personnel are to confine their activities to their specific job work areas. There will be no loitering or access to unauthorized areas of the campus or facility. Use of AISD toilet facilities, cafeteria, or vending areas by construction personnel is prohibited.
2. Potentially hazardous work areas and excavations are to be secured and provided with warning signs, fencing, shoring, shields, guard rails or other adequate protection and warning signage consistent with acceptable standards of safety and as dictated by law.
3. All contractor equipment and tools on AISD facilities must have designed safety guards and accessories intact, functional, and in use. Equipment or devices whose safety certification has been damaged or compromised will not be used or brought onto AISD job sites.
4. It is the obligation and responsibility of the Prime Contractor, their subcontractors, and all related construction personnel to practice appropriate safety techniques to protect the health and well being of themselves, their co-workers, AISD staff, and students.
5. It is the obligation and responsibility of the Prime Contractor to insure that all State and Federal laws pertaining to criminal history checks are met in order to insure that any on-site job related employee is cleared to be on an Alvin ISD facility that may be occupied with students.
6. Radios and other devices that broadcast music publicly are not allowed on occupied campuses.

C. Drugs and Alcohol

Illegal drugs and intoxicants are explicitly excluded from access or use on any Alvin ISD owned property. Those in possession or under the influence of illegal drugs or intoxicants are specifically excluded from access to any AISD property or facility. Violation will result in immediate removal from AISD property and prosecution as appropriate

D. Weapons and Firearms

Weapons and firearms, as defined by the Alvin ISD Police Department, are strictly prohibited on AISD owned property or facilities. Violation of this requirement will result in immediate removal from AISD property and prosecution as appropriate.

E. Tobacco and Vaping Products

Use of tobacco and / or Vaping products is not permitted on AISD owned property (including the perimeter of the property to 100'). Failure to comply with this requirement may result in the violator being removed and excluded from future access to AISD owned properties.

F. Dress Code and Conduct

At all times, construction personnel will be held accountable for wearing appropriate attire. More specifically, no clothing will be allowed on AISD properties that in the view point of AISD Administration or Police Department is outside the limits of acceptable standards for this school district. Specifically excluded are items of clothing that contain wording or graphics that may be viewed as offensive.

Shirts, long pants (secured at the waist), and hard soled closed toed shoes will be worn at all times.

Loud, boisterous, and/or profane language will not be allowed.

Unauthorized interaction with AISD staff or students will not be tolerated. Any action by construction personnel that may be interpreted by AISD's Administration or Police Department as harassing, offensive, teasing, annoying, or nuisance toward any student or staff member will result in immediate removal, permanent suspension of the offender from school property, and follow up prosecution if justified.

Courtesy and consideration of AISD staff and students by construction personnel is mandated and expected at all times.

When working on or around areas that are occupied and operational by AISD, care and consideration will be given to minimizing disruptions such as noise, dust, housekeeping, and any disruption of utilities that may impact ongoing school or business operations.

G. Emergency Situations, Accidents, and Injuries

All situations that result in accidents, near accidents, injuries, or loss must be reported to AISD. As soon as emergency circumstances allow, the supervisor for the prime contractor must notify the AISD Construction Project Manager or the Coordinator of Planning & Construction, of the occurrence. A written report must follow within 2 business days of the mishap.

EMERGENCY CONTACTS FOR ALVIN I.S.D.

AISD Police – 281 331-2320

Bill VanWagner – Director of Planning & Construction Services
Office: 281-245-2555 - Mobile: 281 299-6496 - E-mail: bvanwagner@alvinisd.net

Billie Cunningham - Coordinator, Planning & Construction Services
Office: 281-245-2960 - Mobile 713-806-7749 - E-mail bcunningham@alvinisd.net

Rudy Santos – Construction Services - Project Manager
Office: 281-245-2524 - Mobile: 281-824-2778 - E-mail: rsantos@alvinisd.net

Shannon Tobias - Construction Services - Project Manager
Office: 281-245-2469 - Mobile: 281-245-7008 - E-mail: stobias@alvinisd.net

H. Hazardous Communications Program

The contractor must have in place an effective HazCom program that complies with Federal Guidelines and Occupational Safety and Health Administration regulations.

All contractors and subcontractors must provide a Workplace Chemical List (WPCL) and Material Safety Data Sheets (MSDS) on site for each chemical they expect to use during the construction project. Chemicals needing to remain on site must be stored according to MSDS guidelines.

Care should be taken to control use and reduce the quantity of on site hazardous materials.

I. Housekeeping and Debris Removal

The contractor is required to keep the entire project area clean and free from accumulation of excess debris at all times. Trash and debris must be managed to contain it on site and confined to the dedicated construction area. Trash will be controlled to eliminate objectionable and unsightly conditions and disposed of in a proper and timely manner. Public roads, parking, walks, etc. will be kept clear of mud and water.

This section also pertains to the grounds keeping of all areas within the construction site and/or under the control of the contractor. All grass areas shall be routinely maintained to provide a neat appearance. This includes but is not limited to weed and pest control around all fenced areas.

J. Parking, Staging, and Lay Down Areas

During construction, the contractor will be assigned and limit their activity to the use of designated areas only. In no case will contractor personnel be allowed to park vehicles randomly in AISD staff or student parking spaces at occupied campuses.

K. Disruptions to Utilities, Equipment, Roadways, and Building Safety Features

The availability of utilities, equipment, access roadways, and building safety features all work to insure safe and productive operation of Alvin ISD's plant and facilities. Consistent with that is the need to manage and plan any disruption to the use of these items. Therefore, shutdowns must be requested, planned, and approved well in advance to minimize disruption to AISD's operations.

L. Asbestos

Alvin ISD will endeavor to identify and/or remove or encapsulate any known asbestos containing materials within a project area prior to beginning a construction or repair project.

In the event that any construction personnel encounter materials suspected of being asbestos containing, they will immediately stop construction activity that would further disturb the ACM and notify the AISD representative managing their work. No further activity should commence that would disturb the potential ACM or expose any workers or building occupants to risk of exposure until AISD has acted and authorized such work to commence.

At the completion of the project and as part of the contract close out, the prime contractor will provide a "Certificate of Asbestos Free Construction" certifying that they have reviewed all MSDS's for materials used and all products installed in the project are asbestos free.

M. OSHA and EPA Compliance

In all cases, the contractor, his subcontractors, suppliers, and construction personnel will comply with any and all laws and regulations as set forth by the Occupational Safety and Health Act and the Environmental Protection Agency. The prime contractor is responsible for enforcing these regulations and guidelines at all times. Failure to comply may be cause for cessation of work and termination of the contract.

N. Schedule for Completion

The contractor will include within their contract days, an appropriate number of lost days due to average inclement or adverse weather conditions. Only weather-related days that exceed the 5 year average for the number of days with ½ inch or greater rainfall as measured by the National Weather Service for the greater Houston area will be granted as extra contract time.

No more than one mud day will accompany each rain day for the duration of the contract. Months containing less than the average rainfall will be credited back to the job schedule.

Maintaining the site drainage and dewatering are the responsibility of the prime contractor and not a valid reason for construction delay.

O. Warranty Work

At the Owner's discretion, the prime contractor shall be responsible for enforcing and coordinating completion of all subcontractor and/or manufacturers warranty repairs, for the duration of those warranty periods, including extended warranties. Any special equipment or building modifications required by the contractor to complete warranty repairs will be included in the warranty. No additional costs will be incurred by Alvin ISD.

Alvin ISD utilizes Google Docs Spreadsheet to notify the contractor of items needing attention that may be covered under the contractual warranty periods. At the owner's discretion, the first point of contact will always be the General Contractor whose responsibility will be to make any necessary contacts to subcontractors and/or manufacturers to initiate and facilitate the warranty claims process. Coordination of facility availability and access by subcontractors will be handled through the General Contractor.

The google spreadsheet will be set up so that the Contractor's representative is notified by E-mail when a warranty issue is added by the owner. The issue will be marked as to the level of urgency it may warrant depending upon the needs of the campus staff or students. There are three levels of urgency, each corresponding to an expected response time.

Emergency: Immediate Response

Urgent: Next Business Day

Normal: Within 3 to 5 Business Days.

Included for each Warranty Request will be a description of the needed repair along with any special working conditions or remarks that the contractor may need to be made aware of. Once the repairs have been completed, the request will need to be updated by the contractor's representative on the Google Docs spreadsheet. Afterwards, the repair will be reviewed and approval will be noted on the document by the owner once accepted as complete.

Completion of this process in its entirety is what will be considered as acceptable completion of a Warranty Request.

If the contractor fails to respond in a timely manner or if safety, security, or the well being of the building or its occupants is at risk, AISD reserves the right to complete the warranty work order at the expense of the prime contractor.

P. Aerial Photography

The General Contractor or Construction Manager shall provide monthly aerial drone photography. Photography shall start the month they are given a notice to proceed until one month AFTER Substantial Completion. The images shall be sent electronically monthly to the Owner and Architect. The cost shall be included in the contractor's final bid price or GMP:

All photos taken shall be from the same fixed position each month at an altitude to see the entire building from all corners, and the entire site for at least 2 photos. Confirm all angles and altitudes with the Client and Architect prior to starting and adjust as needed.

All required licenses and permissions shall be obtained by the Aerial Photography company in order to provide this service for this project at this location.

END OF SECTION

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.2 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
   1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.1 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.3 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
d. Serial number of installed unit.
e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.4 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
   1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
   2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
   3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
   4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
   5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
   1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
   2. Examples of Functional Testing:
      a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
      b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
      c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
      d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.5 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:
1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.

7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.6 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
   2. Other points will be monitored by the Commissioning Authority using dataloggers.
   3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   5. Graphical output is desirable and is required for all output if the system can produce it.
   6. Monitoring may be used to augment manual testing.

3.7 OPERATION AND MAINTENANCE MANUALS

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

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

END OF SECTION

SECTION 01 91 14 - COMMISSIONING AUTHORITY RESPONSIBILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:
   1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests performed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed O&M data submittals are specified.
   4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is specified.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

1.2 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.3 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.4 SUBMITTALS

A. Commissioning Plan:
   1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Authority contract.
   2. Submit revised draft to be included in the construction Contract Documents, not less than 4 weeks prior to bid date.
   3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. List of Prefunctional Checklists to be developed:
   1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.

2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
3. Submit final list not more than 60 days after start of construction.

C. Prefunctional Checklists:
1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

D. List of Functional Test procedures to be developed:
1. Submit preliminary list at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised list not less than 6 weeks prior to bid date, for inclusion in Contract Documents; this is intended to be a list of titles, not full description of the tests.
3. Submit final list not more than 60 days after start of construction.

E. Functional Test Procedures:
1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction Contract Documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

F. Training Plan.

G. Recommissioning Manual: Submit within 60 days after receipt of Owner's instructions to proceed with preparation.

H. Commissioning Process Record: Submit to Contractor for inclusion with O&M manuals. Include, at a minimum the following:

I. Final Commissioning Report: Submit to Owner. Include the following:

PART 3 EXECUTION

2.1 COMMISSIONING PLAN

A. Prepare and implement the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.
1. Call and chair meetings of the Commissioning team when appropriate.
2. Give Contractor sufficient notice for scheduling commissioning activities.
3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
4. ASHRAE Guideline 1.1 may be used as a guide for the Commissioning Plan.
5. Avoid replication of information included in the construction Contract Documents to the greatest extent possible.

B. Review the construction Contract Documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

C. Commissioning Schedule:
1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
2. Contractor's scheduling responsibilities are specified in the construction Contract Documents.
3. Revise and re-issue schedule monthly.
4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

2.2 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction Contract Documents; review and submit comments to Owner.
1. These specifications include:
a. Procedures applicable to all types of items to be commissioned.
2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction Contract Documents by Architect:
a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.
b. Additional Owner personnel training.
c. Additional operation or maintenance data that should be submitted.

B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.
1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.
2. The Checklist forms are intended to be part of the Contractor's Contract Documents.

C. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Owner and Architect.
1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.
2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction Contract Documents.

E. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction Contract Documents

2.3 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Prepare forms for Contractor's use, in sufficient detail to document that the work has been installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.
1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.

2. Identify each Checklist by using Contract Documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.
3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.
4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.
5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.
6. Include line items for each physical inspection to be performed.
7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.

B. Prefunctional Checklists - Format:
1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
2. Include on cover sheet space for Contractor's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
   a. "This Checklist is submitted for approval with no exceptions."
   b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

2.4 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to demonstrate that functional performance is in accordance with Contract Documents, including proper operation through specified modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load regimes.
1. Obtain assistance and review by installing subcontractors.
2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
3. Include test setup instructions, description of tools and apparatus, special cautions, and.
4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring, or manual functional testing.

6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.

B. Functional Test Forms: Prepare and distribute forms in advance of testing. Use a consistent format to the greatest degree practicable. For each form, include the following:
1. Signature Block: Signature of the designated commissioning lead and the system and equipment installer attesting that the recorded test results are accurate.

2.5 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager; ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review proposed commissioning schedule, activities, and responsibilities with parties involved. Require attendance by every member of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least monthly.

E. Submit periodic progress reports to Owner and Contractor.

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor.

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor. Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:
1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
4. Review TAB Plan prepared by Contractor.

5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
7. Analyze trend logs and monitoring data to verify performance.

M. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by Owner, and tests by manufacturer's personnel; include documentation in O&M manuals.

N. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.

O. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

P. Operation and Maintenance Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

Q. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

2.6 TRAINING

A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor.
1. Include a ____ hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
2. Include a ____ hour session by the Commissioning Authority on the use of the blank Prefunctional Checklists and Functional Test forms for re-commissioning purposes.
3. Establish criteria for determining satisfactory completion of training.

B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

2.7 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
1. Include the Final Commissioning Plan and Final Report.
2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
   a. Design intent documentation, furnished by Architect or others.
   b. Detailed operational sequences.
   c. Startup plan and approved startup reports.
   d. Filled out Prefunctional Checklists.
   e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
   f. Training plan and training records.
   g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:
1. Executive summary.
2. List of participants and roles.
3. Brief facility description.

4. Overview of commissioning scope and general description of testing and verification methods.
5. For each item commissioned, an evaluation of adequacy of:
   a. The product itself; i.e. compliance with Contract Documents.
   b. Installation.
   c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
   d. O&M documentation, including design intent.
   e. Operator training.
6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).
9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

2.8 POST-OCCUPANCY PHASE

A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.

B. On-Site Review: 10 months after Substantial Completion conduct on-site review with Owner's staff.
   1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
   2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
   3. Make suggestions for improvements and for recording these changes in the O&M manuals.
   4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
   5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION

SECTION 02 41 13.10 - REMOVING EXISTING PAVEMENTS, UTILITIES AND STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks, and driveways.

C. Removing pipe culverts, sewers and water lines.

D. Removing existing inlets and manholes.

E. Removing miscellaneous structures of concrete or masonry.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

B. Include cost of installing suitable backfill material and proper compaction (95% of the Std. Proctor Density) in cost of each item to be removed. No separate pay for this item.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Obtain advance approval from Engineer for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

3.2 PROTECTION

A. Protect the following from damage or displacement:
   1. Adjacent public and private property.
   2. Trees, plants, and other landscape features designated to remain.
   3. Utilities designated to remain.
   4. Pavement and utility structures designated to remain.
   5. Bench marks, monuments, and existing structures designated to remain.

3.3 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of two (2) inches.

D. Where street and driveway saw cut locations coincide or fall within three (3) feet of existing construction or expansion joints, break out to existing joint.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch thick masonry plug in pipe end prior to backfill.

G. When removing existing utilities or structures, all existing backfill material (i.e. cement stabilized sand) shall also be removed. Include in price of utility or structure removed.

3.4 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Division 31.

B. Trench and structure excavations shall be backfilled in 8” lifts and compacted to 95% of the Std. Proctor Density. Reference Geotechnical Report and Plans for details on acceptable backfill.

3.5 DISPOSAL

A. Inlet frames, grates, plates, and manhole frames and covers may remain property of the Owner. Disposal shall be in accordance with requirements of Division 1.

B. Remove from the site debris resulting from work under this section in accordance with requirements of Division 1.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE (BUILDING 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. Cast in place concrete includes the following:
1. Foundations and footings.
    a. Drilled Piers.
    b. Light pole bases.
    c. Flag pole base.
2. Slab on grade.
3. Fill for steel deck.
4. Equipment pads and bases.

C. Related Requirements:

1. Quality Requirements: Materials Section 01 40 00 – testing.
2. Section 03 52 16 – Insulating Concrete Roof Fill
3. Division 09 for requirements relating to specified floor coverings, finishing, and curing of interior concrete floor slabs.
4. Section 31 23 15 - Building Earthwork
5. Section 31 63 29 – Drilled Concrete Piers and Shafts

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. Pre-installation Conference: Conduct conference prior to any work beginning by trade. Time, date and location as determined by a construction manager.

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, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of product.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Designs shall be submitted a minimum of 48 hours prior to the placement of any concrete. Submit properties of mixtures for each class of concrete including:
1. Mixture Identification by class
2. Specified compressive strength, f'_c, that is applicable for the class
3. Specified exposure class in Part 2, “PRODUCTS”, Article “CONCRETE MIXTURES, GENERAL”
4. Documentation of strength test records of similar class of concrete used to establish standard deviation in accordance with ACI 318, when test records exist
5. Required average compressive strength, f'_{cr}, for each class of concrete
6. Documentation of f'_{cr} of proposed mixtures(s)
7. Intended placement method
8. Slump or slump flow
9. Air content
10. Density
11. Water/cement ratio (w/cm), when specified
12. Documentation supporting other specified requirements of concrete mixtures
13. Nominal maximum aggregate size or Size number
14. Type and information about the ingredient materials proposed for use including:
    a. Cementitious Materials
    b. Aggregates
    c. Admixtures
    d. Water
    e. Fibers, color pigments, and other additions
15. Amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Comply with CRSI's "Manual of Standard Practice" and ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures." 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. Original contract drawings shall not be reproduced for use as a portion of the Shop drawing.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
1. Submit original shop drawings indicating the proposed construction joint locations to the Architect/Engineer at least 14 days prior to beginning formwork on the portion of the building in question.

1.6 INFORMATIONAL SUBMITTALS

A. Information submittals are mandatory submittals by the sub-contractor to the General Contractor, Construction Manager and Design Professional which are not returned but kept for the project record.

B. Material certificates in lieu of material laboratory test reports when permitted by Architect/Engineer. For each of the following, material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1. Cementitious materials.
2. Admixtures. Provide certification that chloride content complies with specification requirements.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders. Certificate shall include permeance ratings expressed in grains of water vapor per square foot per hour per inch of mercury.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

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

1. Aggregates**:** Include sieve analysis, dry rodded unit weight of coarse aggregate, and the specific gravities of both fine and coarse aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

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

E. Field quality control reports: The independent testing laboratory shall submit laboratory test reports for concrete materials directly to the Architect/Engineer with copy to others in accordance with the provisions of section 014000 "Quality Requirements." State in each report whether or not the test specimens comply with the specified requirements and indicate any deviations therefrom.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
2. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, & Placing Concrete"
3. ACI 305 "Hot Weather Concreting".
4. ACI 306 "Recommended Practice for Cold Weather Concreting"
5. ACI 311 "Recommended Practice for Concrete Inspection"
6. ACI 318 "Building Code Requirements for Reinforced Concrete."
7. ACI 347 "Recommended Practice for Concrete Formwork"
8. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

B. Mix designs: Test in accordance with the requirements of PART 2 - PRODUCTS, article "PROPORTIONING AND MIX DESIGNS".

A. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: When the manufacturer does not comply with all requirements of Part 1, Quality Assurance, Manufacturer Qualifications, engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures. The manufacturer is permitted to engage a qualified independent testing agency to perform specific tests for project submittals. The contractor is responsible for the cost of the preconstruction testing service.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

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 more than one day in a row, 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.
4. Removal of formwork shall be delayed during cold weather to assure adequate structural strength, unless approved strength accelerating measures are taken.
5. Contractor shall provide to the Architect/Engineer a written description of procedures to be used for cold weather concreting in accordance with Part 1, “ACTION SUBMITTALS”. The details should include, but not be limited to, the following:
    a. Procedures for protecting the subgrade from frost and the accumulation of ice or snow on reinforcement or forms prior to placement.
    b. Methods for temperature protection during placement.
    c. Types of covering, insulation, housing, or heating to be provided.
    d. Curing methods to be used during and following the protection period.
    e. Use of strength accelerating admixtures.
    f. Methods for verification of in-place strength.
    g. Procedures for measuring and recording concrete temperatures.
    h. Procedures for preventing drying during dry, windy conditions.

B. Hot-Weather Placement: Comply with ACI 301 and 305.1 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.
3. Provide submittals required by ACI 305.1 in accordance with Part 1, “ACTION SUBMITTALS”.
4. Water Reducing and Retarding Compound: The manufacturer of the mixture shall submit in writing to the Architect/Engineer and the Contractor, special recommendations for quantities to be used under various temperature and job conditions to assure that the concrete can be maintained at a uniform consistency while in the mixer truck and sufficiently workable between lifts to prevent the occurrence of lift lines with the specified placement and consolidation techniques, and as approved by the Architect/Engineer. Assure that the proper admixture and dosage is used during hot weather (mix temperature over 90 deg F.) to prevent slump loss from plant to site.

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 336.
3. 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. Hole Forms: Plastic, removable, coiling forms for handrail and guardrail post supports.
   1. Basis-of-Design: Econ-O-Post Hole Form, Deslauriers, Inc. 800-743-4106 www.deslinc.com
      a. For post up to 2-3/8 inch outside diameter: EPHF-3.
      b. For post greater than 2-3/8 inch outside diameter to 3-1/2 inch outside diameter: EPHF-4.
   2. Coordinate locations with post indicated on plans, shop drawings, setting drawings and with railing installers. Coordinate form sizes required with post sizes.

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 with a maximum of 450 g/l volatile organic compounds (VOCs) 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 1/2 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.

J. Expanded polystyrene (EPS) and Extruded polystyrene (XPS) Forms: Complies with ASTM D6817 / D6817M, treated to resist insects and suitable for below grade applications; EPA registered treatment, meeting requirements of ICC ES AC239, and recognized in an ISS ES report.

   1. Products: Subject to compliance with requirements, product which may be incorporated in the Work include, but are not limited to, the following:

      a. Foam-Control EPS; 952-892-0809; www.geofoam.com
      b. InsulFoam GF; 403-248-6616; www.insulfoam.com
      c. Atlas EPS; 616-878-1568; www.atlaseps.com
      d. DOW Building Solutions; 800-583-2583; www.building.dow.com
      e. Owens Corning; 800-438-7465; commercial.owenscorning.com/products
      f. Kingspan; 800-241-4402; www.trustgreenguard.com/insulation-board
      g. Substitutions: Section 01 60 00-Product Requirements

   2. Minimum material requirements for EPS and XPS foams:

      a. Size: Largest practicable sizes.
      b. Thickness: As indicated.
      c. Density: As indicated (1.15 lb/cu. ft, min.)
      d. Compressive Strength: As indicated (5.8 psi at 1% deformation, min.)

e. Deformation: 1% maximum.

3. Connector Plates: Manufacturer’s galvanized or stainless steel plates with two-sided multi-barbed design, capable of piercing geofoam and resisting lateral movement between blocks during installation.

4. Lateral Holding Strength: 60 lbs.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars, including Deformed Bar Anchors: ASTM A 706/A 706M, deformed.

C. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

D. Deformed-Steel Wire: ASTM A 1064/A 1064M.

E. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

F. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

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. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780/A 780M.

E. 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 or plastic according to CRSI's "Manual of Standard Practice," and as follows:
1. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. 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.

2.5 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. Type III cement may be used in lieu of Type I at contractor's option, when acceptable to the Architect/Engineer.
2. Fly Ash: ASTM C 618, Class F.
3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single source for exposed concrete.

1. Maximum Coarse-Aggregate Size: As indicated in Section 2.13 “CONCRETE MIXTURES FOR BUILDING ELEMENTS”.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
3. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling. Do not use aggregates containing soluble salts or other substrates such as iron sulfides, pyrite, marcasite or ocher which can cause stains on exposed concrete surfaces.
4. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect/Engineer.

D. Lightweight Aggregate: ASTM C 330/C 330M, as indicated in Section 2.13 “CONCRETE MIXTURES FOR BUILDING ELEMENTS”.

E. Air-Entraining Admixture: ASTM C 260/C 260M.
1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
   a. MasterAir VR 10 or MasterAir AE 200; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
   b. Eucon Air Mix or Eucon Air series; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
   c. Darex AEA or Daravair series; W. R. Grace & Co.-Conn; 866-333-3726; www.graceconstruction.com
   d. Sika AEA series of Sika Air series; Sika Corporation, USA; 800-933-7452; www.sikaconstruction.com

F. 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.
   a. Products: Subject to compliance with requirements, product which may be incorporated in the Work include, but are not limited to, the following:

      1) MasterPozzolith or MasterPolyheed; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
      2) Eucon WR or Eucon MR; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
      3) WRDA series; W. R. Grace & Co.-Conn; 866-333-3726; www.graceconstruction.com
      4) Plastocrete 161; Sika Corporation, USA; 800-933-7452; www.sikaconstruction

2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   a. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

1) MasterSet R 300 ; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
2) Eucon Retarder 75; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
3) Daratard 17; W. R. Grace & Co.-Conn 866-333-3726; www.graceconstruction.com
4) Plastiment; Sika Corporation, USA; 800-933-7452; www.sikaconstruction.com
5) Metco WR; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com

3. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F and/or High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   a. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

      1) Super P; Anti-Hydro International, Inc.; 800-777-1773; www.anti-hydro.com
      2) MasterRheobuild 1000; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
      3) Eucon 37; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
      4) Daracem series or ADVA series; W. R. Grace & Co.-Conn; 866-333-3726; www.graceconstruction.com
      5) Superslump ; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
      6) Sikament series; Sika Corporation, USA; 800-933-7452; www.sikaconstruction.com

4. Water Reducing, Accelerating Admixture: ASTM C 494, Type E.
   a. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

      1) MasterSet FP 20; BASF Construction Chemicals – Building Systems; 722-8899; www.master-builders-solutions.basf.us
      2) ACCELGUARD 80; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
      3) Daraset series; W. R. Grace & Co.-Conn ; 866-333-3726; www.graceconstruction.com
      4) Q-Set; Dayton Superior; 888-977-9600; www.daytonsuperior.com
      5) Accel Set; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
      6) SikaSet NC; Sika Corporation, USA; 800-933-7452; www.sikaconstruction.com

5. Waterproofing and Durability Admixture: ASTM C 494, Type S.
   a. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

      1) Penetron Admix SB; Penetron International, LTD; 631-941-9700; penetron.com

G. 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. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
   a. MasterLife CI 30; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
   b. Eucon BCN or Eucon CIA; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
   c. DCI or DCI-S; W. R. Grace & Co.-Conn; 866-333-3726; www.graceconstruction.com
   d. Sika CNI; Sika Corporation, USA; 800-933-7452; www.sikaconstruction.com

H. Water: ASTM C 94/C 94M and potable. Non-potable water sources, with documented conformance of ASTM C1602, may be submitted for approval by the Architect/Engineer prior to construction.

2.6 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, 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, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
      a. Williams Products, Inc.; 800-521-9594; www.williamsproducts.net
   2. Profile: Flat dumbbell with center bulb at expansion joints and Flat dumbbell without center bulb at construction joint.
   3. Dimensions: Minimum of 4 inches by 3/16 inch thick at cold joints and 6 inches by 3/8 inch thick at expansion joints; nontapered.

B. Flexible PVC Waterstops: CE CRD-C 572, 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, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
      a. Greenstreak; 800-325-9504; www.greenstreak.com
      b. Vinylex Corporation;800-325-3602; www.vinylexwaterstop.com
   2. Profile: Flat dumbbell with center bulb at expansion joints and Flat dumbbell without center bulb at construction joint.
   3. Dimensions: Minimum of 4 inches by 3/16 inch thick at cold joints and 6 inches by 3/8 inch thick at expansion joints; nontapered.

C. Preformed Plastic Adhesive Waterstops: Federal Specification SS S 210A. It shall be supplied in extruded form of suitable cross section and of a size to seal the joint areas of concrete sections. The plastic waterstop shall be protected by a suitable removable two piece wrapper. The two piece wrapper shall be so designed that one half may be removed longitudinally without disturbing the other half, to facilitate application of the sealing compound.
   1. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:
      a. Waterstop-RX; CETCO; 800-527-9948; www.cetco.com
      b. Synko Flex, Henry Company 800-486-1278 www.henry.com
      c. Ram Nex, K.T. Snyder Company, Inc.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Provide manufacturer's recommended mastics and gusset tape at all joints, to create a continuous membrane.
   2. Products for Slab-on-Grade: Subject to compliance with requirements, products which may be incorporated in the Work include the following:
      a. VB-350; Inteplast Group; 877-535-0555; www.barrierbac.com
      b. VaporBlock Plus; Raven Industries Inc.; 605-335-0174; www.ravenefd.com
      c. 15 mils thick Stego Wrap; Stego Industries, LLC; 877-464-7834; www.stegoindustries.com
      d. 15 mils thick Perminator; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com
      e. Polyethylene sheet not less than 15 mils thick (must provide proof of compliance with ASTM E 1745).

B. Bituminous Vapor Retarder: 110-mil- thick, semiflexible, seven-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weathercoating, and removable plastic release liner. Furnish manufacturer's accessories, including bonding asphalt, pointing mastics, and self-adhering joint tape.
   1. Product: Subject to compliance with requirements, products which may be incorporated in the Work include the following:
      a. Premoulded Membrane Vapor Seal with Plasmatic Core; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com
   2. Water-Vapor Permeance: 0.0011 grains/h x sq. ft. x inches Hg; ASTM E 154.
   3. Tensile Strength: 140 lbf/; ASTM E 154.
   4. Puncture Resistance: 90 lbf; ASTM E 154.

2.8 CHEMICAL HARDENERS

A. Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gal.
   1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
      a. MasterKure HD 300WB; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
      b. Surfhard; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
      c. Liqui-Hard; W.R. Meadows, Inc. 800-342-5976; www.wrmeadows.com

2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components complying with ASTM C 309, Type I-D, Class A; odorless; that penetrates, hardens, and densifies concrete surfaces.

   1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 mg per liter.
   2. Do not use curing compound on recessed slab areas which receive paver tile, quarry tile, ceramic tile or terrazzo finish floor material. These areas shall be water cured only.
   3. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
      a. A-H 3 Way Sealer WB Anti-Hydro International, Inc. 800-777-1773; www.anti-hydro.com

b. MasterKure CC series BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
c. Cure and Seal series; Dayton Superior; 888-977-9600; www.daytonsuperior.com
d. Eucocure VOX; Euclid Chemical Company ;800-321-7628; www.euclidchemical.com
e. L&M Cure R; LATICRETE International, Inc.; 800-243-4788; www.laticrete.com
f. Seal N Kure; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
g. CS-309-25; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

2.10 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
a. MasterKure ER 50; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
b. Aquafilm series; Dayton Superior; 888-977-9600; www.daytonsuperior.com
c. Eucobar; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
d. E-Con; LATICRETE International, Inc.; 800-243-4788; www.laticrete.com
e. Waterhold; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
f. Evapre; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

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.
1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
a. MasterKure CC Series; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
b. Cure and Seal series Dayton Superior 888-977-9600 www.daytonsuperior.com
c. Aqua-Cure VOX; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
d. Dress & Seal WB; LATICRETE International, Inc.; 800-243-4788; www.laticrete.com
e. Metcure; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
f. Vocomp-20;W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

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.
1. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. Polyvinyl Acetate (Interior Only):
   1) PVA Bonding Agent J41; Dayton Superior; 888-977-9600; www.daytonsuperior.com
   2) Tammsweld; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
   3) Weld-Crete ; Larsen Products Corp.; 800-633-6668; www.larsenproducts.com
   4) Herculox; Metalcrete Industries; 800-526-5602 ; www.metalcreteindustries.com
   5) Intralok ; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com
b. Acrylic or Styrene Butadiene:
   1) MasterEmaco A 660; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
   2) Acrylic Bonding Agent J40; Dayton Superior; 888-977-9600; www.daytonsuperior.com
   3) SBR Latex; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
   4) Daraweld C; W. R. Grace & Co.-Conn; 866-333-3726; www.graceconstruction.com
   5) Everbond; LATICRETE International, Inc.; 800-243-4788; www.laticrete.com
   6) Acrylpave; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
   7) Acry-Lok; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

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. Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
   a. MasterInject 1500; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us
   b. Sure Bond J58 ; Dayton Superior; 888-977-9600; www.daytonsuperior.com
   c. Euco Epoxy System #452; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com
   d. Epobond; LATICRETE International, Inc.; 800-243-4788; www.laticrete.com
   e. Metco Hi Mod Epoxy; Metalcrete Industries; 800-526-5602; www.metalcreteindustries.com
   f. Sikadur 32 Hi-Mod; Sika Corporation, USA; 800-933-7452; www.sikaconstruction.com
   g. Stonset Primer; Stonhard; 800-257-7953; www.stonhard.com
   h. Rezi-Weld 1000; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

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.

2.12 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 5000 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.

2.13 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 testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures. Use qualified testing agency to develop supplementary performance test data for additional requirements identified in this specification.

2. Design mixtures shall meet the specified strength and durability requirements listed below or as provided in the Contract Documents, whichever is more stringent. Exposure classes listed below are defined by ACI 318, and the design mixture shall comply with the durability requirements of each exposure class.

B. Cementitious Materials - Unless otherwise indicated in the Contract Documents or as indicated below, concrete mixtures may use any cementitious materials listed in PART 2 section “Concrete Materials”.
1. Cementitious materials other than Portland cement shall not exceed the ACI 318 limits for the designated exposure classifications of each mix class.

C. Limit water-soluble, chloride-ion content in hardened concrete to following limits depending on the exposure category assigned to the structural member identified in this section of the specification or in the contract documents, whichever is more stringent. The limits are stated in terms of chloride ions in percent by weight of cement.
1. Reinforced in Exposure Category C0 – 1.00%
2. Reinforced in Exposure Category C1 – 0.30%
3. Reinforced in Exposure Category C2 – 0.15%

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.

E. Air Content: Provide total air content for each class of concrete based on the nominal maximum size of aggregate and the assigned exposure class for resistance to freezing and thawing indicated in 2.12. Concrete for members categories as Exposure Category F0 should be non-air entrained, unless noted otherwise on the Contract Documents.

Nominal Maximum Aggregate Size, inch	Total Air Content (%)	
	Exposure Class F2 and F3	Exposure Class F1
3/8	6.0 to 9.0%	4.5 to 7.5%
1/2	5.5 to 8.5%	4.0 to 7.0%
3/4	4.5 to 7.5%	3.5 to 6.5%
1	4.5 to 7.5%	3.0 to 6.0%
1-1/2	4.0 to 7.0%	3.0 to 6.0%
2	3.5 to 6.5%	2.5 to 5.5%
3	3.0 to 6.0%	2.0 to 5.0%

F. Slump – Provide documentation in submittal prior to commencement of Work of target slump or slump flow value for each class of concrete. Consistency of concrete shall be established to facilitate placement with minimized potential for segregation.

G. Alkali silica reactivity – For structural concrete members that will be moist in service and when it is determined as per Section 2.2B that the aggregate source used needs to include mitigative measures, submit documentation demonstrating that the proposed cementitious materials used with the aggregates by ASTM C1567 tests with an expansion after 14 days of exposure less than or equal to 0.1%.

H. The installer and manufacturer shall coordinate to establish properties of fresh concrete to facilitate placement and finishing with reduced potential for segregation and bleeding. Factors shall include but are not limited to slump or slump flow, setting time, method of placement, rate of placement, hot and cold weather placement, curing, and concrete temperature. Selection of fresh concrete properties shall be notified to the Engineer of Record in the submittal.

I. Contractor shall indicate reportable changes in sources of materials and quantities when such changes are necessary to ensure constructability, performance of concrete and compliance with the specification requirements. The contractor is permitted to make minor adjustments less than the reportable deviations noted in the original submittal to concrete mixtures to ensure uniformity of concrete without a re-submittal for review or approval.

2.14 FABRICATING REINFORCEMENT

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

B. Identification: Deliver all reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

C. Rejected Materials: Reinforcing with any of the following defects will not be permitted in the work:
   1. Bar lengths, depths, and bends exceeding the specified fabrication tolerances. Bends or kinks not indicated on drawings or final shop drawings.
   2. Bars with reduced cross section due to excessive rusting or other cause.

2.15 CONCRETE MIXING

A. General: Concrete may be mixed at batch plants or it may be transit mixed as specified herein. Batch plants must comply with the requirements of ACI 304, with sufficient capacity to produce concrete of the quality specified, in quantities required to meet the construction schedule. All plant facilities are subject to the acceptance of the Architect/Engineer. Plant facilities shall be calibrated by testing agencies specifically qualified for this as frequently as necessary to insure accuracy to plus or minus 0.4% of the total capacity of the components of the plant, but at a frequency not to exceed 6 months.

B. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, furnish batch ticket information, and as specified, provided the quantity and rate of delivery will permit unrestricted progress of the work in accordance with the placement schedule. Discharge of the concrete shall be completed within l l/2 hours after water is added to the mix or by the time the drum has revolved 300 times, whichever occurs first.

   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.

C. 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. Do not exceed the catalog rating or nameplate capacity for a total volume of materials used per batch.
   4. Equip the mixer with automatic controls, or semi-automatic controls, if acceptable, for proportioning materials and the proper measured quantities.
   5. Do not exceed 30 minutes total elapsed time between intermingling of damp aggregates and cement to the discharge of the completed mix.
   6. 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.\

2.16 FABRICATION OF REINFORCEMENT

A. General: Shop-fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Identification: Deliver all reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

C. Rejected Materials: Reinforcing with any of the following defects will not be permitted in the work:

1. Bar lengths, depths, and bends exceeding the specified fabrication tolerances. Bends or kinks not indicated on drawings or final shop drawings.
2. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of the structure during construction.

B. Construction loads, including reshoring loads, on in place construction shall at no time exceed the live load for which the in place construction was designed. If the contractor is uncertain about the design live loads, it shall be his responsibility to obtain these from the Architect/Engineer.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
   1. Earth forming of grade beams is permitted, with the exception that the top 6-inches of exterior grade beams must be formed. Earth forming must be accompanied by lime-stabilization of the subgrade to prevent sloughing. Trench width shall be 2-inches wider than stated beam width to account for increase cover thickness required by ACI, i.e. 3-inches at sides and bottom for cast-against earth.

D. 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 C, 1/2 inch for rough-formed finished surfaces.

E. Construct forms tight enough to prevent loss of concrete mortar.

F. 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.

G. 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.

H. 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.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. Forms for Exposed Concrete: Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.

1. Do not use metal cover plates for patching holes or defects in forms.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

L. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

M. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

N. Coat contact surfaces of forms with an approved, non-residual, low-VOC form-release agent, according to manufacturer's written instructions, before placing reinforcement.

1. Do not allow excess form coating material to accumulate in forms or come into contact with in place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
2. Coat steel forms with a non-staining, rust preventative material. Rust stained steel formwork is not acceptable.

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. Anchor bolts shall be set with securely fastened templates, and the threaded area shall be protected from concrete laitance. Anchor bolts shall be 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.
    a. Where conduit, pipe, or other items are to be embedded in concrete beams, slabs, or columns, they shall be placed not closer than the diameter of the largest of the adjacent items and with a net reduction in the concrete area (of a 12 inch wide strip in slabs) not in excess of 9% without prior approval of the Engineer. The location of such embedded items shall generally be at the middle or centroid of the member.
3. Install dovetail anchor slots in concrete structures as indicated.
4. Hole Forms for Slabs: Install “hole forms” in concrete structures where railing posts are indicated on drawings.
5. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike off templates or compacting type screeds.

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 may not be removed in less than 14 days and until concrete has achieved at least 70 percent of its 28-day design compressive strength. Determine

potential compressive strength of in place concrete by testing field cured specimens representative of concrete location or members.

2. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

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. 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.

C. Keep reshores in place a minimum of 15 days after placing upper tier, or longer, if required, until concrete has attained its required 28 day strength and heavy loads due to construction operations have been removed.

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 reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect/Engineer to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Provide sufficient numbers of supports and of strength to carry the reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar

support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

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.

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. Locate construction joints, if required, but not shown so as to divide the slab into areas not in excess of 6000 sq. ft.(as close to square in configuration as possible), unless otherwise accepted by the Architect/Engineer. Con-form to slab placement, where shown. Before adjacent pour is made, the surface shall be roughened to an amplitude of a minimum of 1/4 inch except at exposed surfaces.

2. 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.
3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete. Bulkheads designed and accepted for this purpose may be used for slabs. Keyways are to be horizontal or vertical as directed by the Architect/Engineer. Install preformed plastic adhesive waterstops in the keyway of all construction joints where vinyl, bulb type waterstops are not detailed.
4. 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.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated in the Construction Documents. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
7. Use a bonding agent 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. 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, dislodge aggregates, and before concrete develops random contraction cracks, but not longer than 12 hours after slab finishing.
2. Formed Contraction Joints: Insert premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. Tool slab edges round on each side of insert. After concrete has cured, at least 7 days remove inserts and clean groove of loose debris.
3. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.

4. If joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third bays).

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. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

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. Notify other trades to permit installation of their work. Notify the Architect/Engineer and Testing Laboratory 24 hours before placing concrete.

B. 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.

C. Do not use concrete which becomes non-plastic and unworkable, or does not meet the requirements quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location.

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.

E. Concrete Conveying: Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods which will prevent segregation and loss of concrete mix materials.

1. Provide mechanical equipment of such size and design for conveying concrete to insure a continuous flow of concrete at the delivery end. Provide run ways above top of finished slab in all places for wheeled concrete conveying equipment for the concrete delivery point to the locations of final deposit. Do not wheel concrete directly over steel

reinforcement. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.

F. Pumping Concrete: The Contractor may at his option use pumping machines for placing the concrete subject to the following requirements:
1. If for pumping requirements the mix design is other than specified, the Contractor shall furnish to the Architect/Engineer a mix for approval not less than 15 days prior to the time required for its use. The laboratory will make and test this mix design. After the results of these tests are noted and approval is received, this mix can be used. Cost of this laboratory work shall be paid by the Contractor.
2. Whenever concrete is placed by pumping, it is recommended a second pump complete with sufficient pipes and hose for a complete and independent set up, or other placement equipment, be at the job prior to any placing of concrete. The Contractor shall be responsible for any corrective work which results from equipment breakdown.

G. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

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 309.
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.

H. 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.

I. Bonding: Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent. Clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and to not leave laitance, loose particles of aggregate, or damaged concrete at the surface.

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, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system.

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.

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. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.

2. After placing slabs, finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

3. Slope surfaces uniformly to drains where required.

C. Float Finish: After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. 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. Uniformly slope surfaces to drains. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo; and where indicated.

2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

    a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

D. 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 monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

E. 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.

F. 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.

G. Chemical Hardener Finish: On concrete floors which remain exposed and as directed apply chemical hardener finish to interior concrete floors. Apply liquid chemical hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water (parts of hardener/water as follows), and apply in 3 coats; first coat, 1/3 strength; second coat, 1/2 strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.

1. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions.

2. After final coat of chemical hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

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 as indicated on the Contract Documents.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
4. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. 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. 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.

B. 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.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. 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 three 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 4-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 3 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, followed by shading or moist curing adequate to keep temperature of the concrete at 80 degrees F or below during the curing period. 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.

5. Temperature of Concrete During Curing: When the atmospheric temperature is 85 degrees F. and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of Part 1 “GENERAL”, Article “FIELD CONDITIONS”.

6. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations. Concrete trucks, cranes, or excessive concentrations of loads will not be permitted on any slab without prior written approval of the Architect/Engineer during the curing period or subsequent construction.

7. Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

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 (7) 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. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

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 1/4 inch in any dimension to solid concrete. Limit cut depth to 1 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, pop-outs, 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. 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.

5. 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. Under no circumstances will "dusting" of wet concrete during finishing operations be allowed.

3.17 SOURCE QUALITY CONTROL

A. Concrete Batch Facility: The testing laboratory shall perform inspections of the concrete batching facility at intervals not to exceed one per 1,000 cubic yards of concrete placed or at least one each six months. The inspection shall include verification of the calibration of scales, aggregate analysis of the current stockpiles, verification of batching procedures, and compliance with the original mix design. First inspection shall take place before any concrete is placed. The cost of each inspection shall be paid by the testing allowance.
   1. Test results will be reported in writing to Architect, Structural Engineer, ready mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7 day tests and 28 day tests. If any breaks are below specified or expected strengths, the Testing Laboratory shall report any visible anomalies.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

   1. The testing laboratory shall monitor concrete properties at time of placement and report to the Contractor any deviation from the project specifications. It shall be the responsibility of the Contractor to control the concrete and comply with the project specifications. If the Contractor cannot adequately control the quality of the concrete, then the Architect/Engineer shall direct the testing laboratory to control the concrete. The cost of this service shall be paid for by the Contractor.

B. Perform testing and inspections as indicated on the Contract Documents.

C. 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. One specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

      a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM 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.
3. 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.
4. 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.
5. 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.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
    b. For pumped concrete, one set of compression test cylinders shall be obtained at both the point of discharge and point of placement.
7. Curing of Compression Test Specimens: After preparation of the test cylinders, to prevent evaporation of water from the unhardened concrete, cover the cylinders immediately after finishing with a non-reactive plate or impervious plastic sheeting. Protect the outside surface of cardboard molds from any source of water for the first 24 hours after casting. Field curing procedures for test cylinders for 28 day compressive strengths are not the same as those for determining strength for form removal time.
    a. For test cylinders for 28 days compressive strength determination, during the first 24 hours after molding, store all test cylinders under conditions that maintain the temperature immediately adjacent to the cylinders in the range of 60 to 80 degrees F. and prevent loss of moisture from the specimens. If the Architect/Engineer or testing laboratory have questions concerning the storage temperature, they may require that the contractor provide a temperature record of the cylinders by means of maximum minimum thermometers. At the end of 20 hours plus or minus four hours, cylinders are to be transported to the laboratory, removed from the molds, and placed in a moist condition at 73.4 plus or minus 3 degrees F. until the moment of testing.
    b. Cure test cylinders to be used for determining strength for form removal time as nearly as practical in the same manner as the concrete in the structure. Cylinders shall be stored in or on the structure as near the point of use as possible, and as far as is practical, with the same exposure to the elements. Remove test cylinders from field storage and store in lime water at 73.4 plus or minus 3 degrees F. for 24 hours plus or minus 4 hours immediately before testing.
    c. Cylinders shipped from the field to the laboratory shall be packed in sturdy wood boxes or other suitable containers surrounded by wet sawdust or other suitable packing material and shall be protected from freezing during shipment.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimens at 7 days, two specimens at 28 days, and retain one specimen in reserve for later testing if required.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
    c. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to additional testing as herein specified.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. 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.
11. 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.
12. 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.
13. 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.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

E. Formed Concrete Dimensional Tolerances: Formed concrete having any dimension smaller than required, and outside the specified tolerance limits, will be considered deficient in strength and subject to additional testing as herein specified.
1. Formed concrete having any dimension greater than required will be rejected if the appearance or function of the structure is adversely affected, or if the larger dimensions interfere with other construction. Repair, or remove and replace rejected concrete as required to meet the construction conditions. When permitted, accomplish the removal of excessive material in a manner to maintain the strength of the section without affecting function and appearance.

F. Strength of Concrete Structures: The strength of the concrete structure in place will be considered potentially deficient if it fails to comply with any of the requirements which control the strength of structure, including the following conditions:
1. Failure to meet compressive strength test requirements.
2. Concrete which differs from the required dimensions or location in such a manner to reduce strength.
3. Concrete subjected to damaging mechanical disturbances; particularly load stresses, heavy shock, and excessive vibration.
4. Poor workmanship and quality control likely to result in deficient strength.

3.19 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 03 30 00

SECTION 03 35 43 - SPECIAL CONCRETE FLOOR FINISHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: This section specifies polished concrete.

B. Related Sections:

1. Section 07 92 00 "Joint Sealants" for sealants in concrete floor surfaces.
2. Section 03 30 00 “Cast-in-Place Concrete”

1.2 REFERENCES

A. American Concrete Institute (ACI)
1. CI 302.IR – Guide for Concrete Floor and Slab Construction.

B. ASTM International

1. ASTM C309 – Standard Specification for Liquid Membrane Forming Compounds for C Curing Concrete.
2. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
3. ASTM C779 – Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
4. ASTM C805 - Standard Test Method for Rebound Number of Hardened Concrete.
5. ASTM E 1155 – Standard Test Method for Determining Floor Flatness and Levelness Using the F number system.

C. Reunion Internationale des Laboratories D'Essais et de Recherches sur les Constructions (RILEM)
1. RILEM Test Method 11.4 Standard Measurement of Reduction of Moisture Through Horizontal Concrete Surfaces.

1.3 PERFORMANCE REQUIREMENTS

A. Provide polished flooring that has been selected, manufactured and installed to achieve the following:

1. Abrasion Resistance: ASTM C779, Up to 400% increase in abrasion resistance.
2. Reflectivity: Increase of 35% as determined by gloss meter.
3. Waterproof Properties: RILEM Test Method 11.4, 70% or greater reduction in absorption.
4. Impact Strength: ASTM C805, Up to 21% increased impact strength must meet or exceed ADA/OSHA suggested 0.5 standard value for the Static Co-efficient of Friction.

B. Design Requirements

1. Hardened Concrete Properties
   a. Minimum Concrete Compressive Strength: 3500 psi
   b. Normal Weight Concrete, No light weight aggregates
   c. Non-air entrained concrete
   d. Fly Ash Content not to exceed 10%

2. Placement Properties for New Concrete
   a. Natural concrete slump of 4 1/2 inches - 5 inches, Admixtures may be used
   b. Flatness Requirements
      1) Overall Ff 50
      2) Local Ff 35
3. Hard-Steel Trowelled (3 passes) Concrete
   a. No burn marks. Finish to ACI 302.IR, Class 5 floor.
   b. Contractor shall take special care to avoid over-troweling initial concrete finish which may burn the surface.
4. Curing Options
   a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure). Acrylic curing and sealing compounds not recommended.
   b. Sheet membrane (ASTM CI71) Polyethylene film not recommended.
   c. Damp curing: Seven-day cure.
   d. Sodium Silicate Curing Compound. Apply per manufacturer's written instructions.

1.4 PRE INSTALLATION MEETINGS

A. Pre-Installation Conference: Conduct conference at project site

1.5 ACTION SUBMITTALS:

A. Product Data: For each type of product indicated

1.6 INFORMATIONAL SUBMITIALS

A. Test Reports: Certified test reports, from an Independent Testing Laboratory, showing compliance with specified performance criteria and physical properties as cited in Performance Requirements above.

B. Certificates:

1. Product and installer certificates signed by the manufacturer certifying materials meet specified performance characteristics and criteria and physical requirements.
2. Current installation contractor's certificate signed by manufacturer declaring contractor as a certified installer of polishing system, prior to bidding of project.

1.7 CLOSEOUT SUBMITIALS:

A. Warranty: Submit warranty documents specified.

B. Maintenance Data: For polished concrete finishing to include in maintenance manuals. Also include the following.

1. Manufacturer's instructions on maintenance renewal of applied treatments.
2. Protocols and product specifications for joint filling, crack repair and/or surface repair.

1.8 QUALITY ASSURANCE

A. Manufacturers Qualifications:

1. Manufacturer has a minimum of 5 years' experience in manufacturing components similar to or exceeding requirements of project.
2. Manufacturer must be able to provide technically trained field representative during

construction and approving application method.

B. Installer Qualifications

1. Installer experienced in performing work of this section who has specialized in installation work similar to that required for this project.
2. Installer trained and having current certification for RetroPlate Concrete Polishing System.

C. Mock-Ups

1. Mock-up size: 10'x10' floor area at job site, at location as directed under conditions.
2. similar to those which will exist during actual placement. Divide mock-up area into 4 equal zones, allowing for sequential attempts to determine amount of aggregate exposure, and color (if required) and shine selection.
3. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine level.
4. Allow 24 hours for inspection of mock-up before proceeding with work
5. When accepted, mock-up will demonstrate minimum standard of quality required for this project.

D. Basis of Design:

1. Class B, Salt/Pepper Finish.
2. Level 2, Medium Gloss, up to and including an 800-grit polish with a gloss reading of 20-30.
3. Color: As determined by Owner based upon installer's mock-up samples.

E. Sequence with Other Work: Comply with Manufacturer's written recommendations for sequencing construction operations.

1.9 DELIVERY, STORAGE & HANDLING

A. Ordering:

1. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery:

1. Deliver materials in manufacturer's original packaging with identification labels and seals intact

C. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer
2. Protect Concrete Slab
   a. Protect from petroleum stains during construction.
   b. Diaper all hydraulic lifts and power equipment.
   c. Restrict vehicular parking, drop cloths will be placed under vehicles parked on slab
   d. No pipe cutting machinery will be used on interior floor slab.
   e. Steel will not be placed on interior floor slab to avoid rust staining.
   f. No acids or acidic detergents will come into contact with slab

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install work until ambient temperature and humidity conditions are maintained at levels indicated in reference standards.

1.11 WARRANTY

A. Project Warranty: Refer to Contract Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and does not limit, other rights Owner may have under Contract Documents.

PART 2 - PRODUCTS

2. 1 PRODUCTS, GENERAL

A. Ensure concrete finishing components and materials are from single source, from single manufacturer.

2.2 POLISHED CONCRETE FINISHING PRODUCTS

A. Basis of Design Product: Advanced Floor Products, RetroPlate Systems
1. Contact: P 0 Box 80533, Provo, UT 84605, Telephone: (800)998-5664; Deke Rife, {402) 598-0801 deke@retroplatesystem.com.

B. Proprietary Products/Systems:
1. Hardener, Sealer, Densifier: RetroPlate 99 - penetrating, water based, odorless liquid, VOC compliant, environmentally safe chemical, will leave no film on surface.
a. Use only silicate type densifiers.
b. Use no siliconates.
2. Joint Filler: Crete Fill, semi-rigid, 2 component, self-leveling, 100% solids, rapid curing, polyuria control joint and crack filler with a choice of 65, 75 or 85 Shore-A hardness.
a. Color to be selected by Architect.
b. Floor mockup shall include a filled joint.
3. Oil Repellent Sealer: RetroPel.
4. Cleaning Solution: CreteClean Plus.
5. Stain Protector: RetroGuard.

C. No Substitutions Allowed.

D. Where color is indicated, color is to be achieved using ChemSystems Chromastain. Solvent or water-based dyes not permitted.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installations and Advanced Floor products Spec-Data sheets

3.2 EXAMINATION

A. Site Verification of Conditions.

1. Verify that concrete substrate conditions which have been previously installed under other sections or contracts are acceptable for product installation in accordance with

manufacturer's instructions prior to installation of finishing materials.

2. Verify concrete is cured to 28 days or 3500 psi strength.

3.3 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of Concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

3.4 INSTALLATION

A. Floor Surface Polishing and Treatment.

1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide Consistent finish in all contiguous areas.

2. Apply floor finish prior to installation of fixtures and accessories.

3. Diamond polish concrete floor surfaces with proper grinding equipment, recommended by Polishing system representative.

a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level.

b. Sequence with coarse to fine grit (Level 1, 1500 grit) using dry method using incrementally finer grit polishing until achieving level of polish and sheen that matches approved floor mockup.

c. Maintain sharp demarcation line between polished surfaces and other finishes.

d. Expose aggregate in concrete surface only as determined by approved mock-up.

e. All concrete surfaces shall be as uniform in appearance as possible.

4. Apply RetroPlate 99, Hardener-Densifier as follows;

a. Apply RetroPlate 99 at 200 sq. ft. per gallon, according to manufacturer's directions

b. Apply RetroGuard according to manufacturer's directions.

c. Remove defects and re-polish defective areas.

d. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.5 FINAL CLEANING

A. Mechanically scrub treated floors for seven days with soft to medium pads using approved Cleaning solution (Crete Clean Plus).

B. Upon completion, general contractor must remove surplus and excess materials, rubbish, tools and equipment.

3.6 PROTECTION

A. Protect installed product (Polished floors) from damage during construction.

1. Do not allow vehicles on the concrete floor. Do not transport materials across floor without protection from scuffing and/or staining.
2. Do not cut or fit pipes, masonry, or drywall over the finished floor.
3. Do not store materials on the floor that may affect curing or sheen.
4. Do not slide equipment, boxes, or furnishings across the floor.

END OF SECTION

SECTION 03 52 16 – INSULATING CONCRETE ROOF FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formed non-structural cementitious lightweight insulating roof fill over metal roof deck.
   2. Openings for roof accessories.
   3. Perimeter joints and control joints at vertical interruptions.

B. Related Sections:
   1. Section 01 40 00 – Quality Requirements: Materials testing.
   2. Section 05 31 23 – Steel Roof Decking.
   3. Section 05 50 00 – Metal Fabrications: Steel framed openings in roof deck.
   4. Section 06 10 53 – Miscellaneous rough Carpentry: Wood nailers, wood curbs, and wood-framed openings in roof deck.
   5. Section 07 54 05 – Thermoplastic Membrane Roofing.
   6. Section 07 71 00 – Roof Specialties: Manufactured roof curbs.
   7. Section 07 72 00 – Roof Hatches: Access and smoke hatches in roof openings.

1.2 SUMMARY

A. This Section includes cast-in-place lightweight concrete roof insulation for roof decks.

1.3 DEFINITIONS

A. Lightweight Concrete Roof Insulation: Low-density concrete, with an oven-dry unit weight not exceeding 50 lb/cu. ft. (800 kg/cu. m), placed with or without embedded rigid insulation, and classified as follows:

   1. Aggregate Lightweight Concrete: Low-density concrete made with Portland cement, water, air-entraining admixture, and either perlite or vermiculite mineral aggregates.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include mixing and application instructions for each type of lightweight concrete roof insulation.

B. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight concrete roof insulation thicknesses, embedded board insulation, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.

C. Design Mixes: For each lightweight concrete roof insulation mix.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated, based on comprehensive testing of current materials:

   1. Cement.
   2. Aggregates.
   3. Admixtures.
   4. Insulation board.

E. Research/Evaluation Reports: Evidence of lightweight concrete roof insulation's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed lightweight concrete roof insulation 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.

1. Installer shall be approved by lightweight concrete roof insulation manufacturer.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. FM Listing: Provide lightweight concrete roof insulation evaluated by FM as part of a roof assembly and listed in FM's "Approval Guide" for Class 1 fire rating and Class 1-90 windstorm ratings.

D. Provide vermiculite aggregates containing no detectable asbestos as determined by the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

E. Provide copy of Manufacturer’s 20 year, NDL warranty with the same Manufacturer’s roofing warranty.

F. Installer is responsible for insuring positive drainage of the insulation deck . Ponding water shall be cause for rejection of the installation. Prior to installation of the roof system, the installer shall perform a ponding water test on the deck to confirm deck drainage. Test shall be conducted in the presence of the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.7 PROJECT CONDITIONS

A. Do not place lightweight concrete roof insulation unless ambient temperature is 40 deg F (4.4 deg C) and rising.

B. Do not place lightweight concrete roof insulation during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include the following:

1. Cellular-Type Lightweight Insulating Concrete:
   a. Celcore Incorporated.
   b. Elastizell Corporation of America.
   c. Siplast Inc.

2. Substitutions: Section 01 60 00 - Product Requirements.

2.2 CELLULAR-TYPE INSULATING CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I II or III.

A. Foam Concentrate: Protein-based foam concentrate conforming to ASTM C869 and ASTM C796.

B. Joint Filler: ASTM C 612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi (172 kPa).

C. Molded-Polystyrene Insulation Board: ASTM C 578, Type I, 0.90-lb/cu. ft. (15-kg/cu. m) minimum density. Provide units with keying slots of approximately 3 percent of board's gross surface area.

D. Curing Compound: Type recommended by manufacturer.

2.3 DESIGN MIXES - GENERAL

A. Prepare design mixes for each type and strength of lightweight concrete roof insulation by either laboratory trial batch or field-test data methods. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Limit use of fly ash to not exceed 25 percent of Portland cement by weight.

B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

C. Do not use the same testing agency for field quality-control testing.

D. Do not use Calcium dioxide in Lightweight concrete.

2.4 CELLULAR-TYPE LIGHTWEIGHT INSULATING CONCRETE

A. Cellular Mix: As follows:
1. Wet Density: 53 to 63 lb./cu. ft. when tested according to ASTM C138.
2. Oven-Dry Density: 31 to 37 lb/cu.ft., when tested according to ASTM C 495.
3. Compressive Strength: Minimum 200 psi when tested according to ASTM C 495.

PART 3 - EXECUTION

3.1 INSPECTION and PREPARATION

A. Metal Deck: Ensure that metal deck to receive insulating concrete fill is galvanized and ventilated to meet manufacturer's requirements. Neither cellular nor vermiculite type lightweight concrete roof insulation shall be installed over a non-ventilated deck regardless of whether allowed by manufacturer or submittals.

B. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of lightweight concrete roof insulation. Fill control joints with joint filler.

1. Provide 1 inch (25 mm) wide control joints for roof dimensions up to 100 feet (30 m) in length; 1-1/2 inch (38 mm) wide control joints for roof dimensions exceeding 100 feet (30 m).

3.2 MIXING AND PLACING

A. Mix and place lightweight concrete roof insulation according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mix and loss of air content.

C. Install insulation board according to lightweight concrete roof insulation manufacturer's written instructions. Place board insulation in wet, lightweight concrete slurry poured a minimum of 1/8 inch (3 mm) over the structural substrate. Ensure full contact of board insulation with slurry, stagger joints, and tightly butt insulation boards.

1. Install insulation board in a stair-step configuration with a maximum step-down of 1 inch (25 mm).
2. Provide total system thickness of minimum 7.5-inches and R-25 or greater.

D. Deposit and screed lightweight concrete roof insulation in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.

E. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.

F. Begin curing operations immediately after placement, and air cure for not less than three days according to manufacturer's written instructions.

G. If ambient temperature falls below 32 deg F (0 deg C), protect lightweight concrete roof insulation from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.

3.3 CURING

A. Protect insulating concrete from excess evaporation of surface moisture.

B. During low humidity conditions, sprinkle water over concrete surface to aid hydration and curing.

C. Apply curing compound where recommended by manufacturer.

D. Protect installed lightweight concrete from rain until installation of roof membrane.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports evaluating lightweight concrete roof insulation. Sampling and testing for quality control may include requirements specified in this Article.

1. Testing agency shall take samples according to ASTM C 172, except as modified by ASTM C 495, and comply with the following:

a. Determine as-cast unit weight during each hour of placement, according to ASTM C 138.
b. Determine compressive strength and oven-dry unit weight according to ASTM C 495. Make a set of at least 6 molds for each day's placement, but not less than 1 set of molds for each 5000 sq. ft. (465 sq. m) of roof area.
c. Report test results to Architect, Contractor, and lightweight concrete roof insulation Installer within 24 hours of completion of each test.
d. Perform additional tests when test results indicate as-cast unit weight, compressive strength, oven-dry unit weight, or other requirements have not been met.
1) Retest cast-in-place lightweight concrete roof insulation according to ASTM C 513 for compressive strength and oven-dry unit weight.

3.4 DEFECTIVE WORK

A. Refinish, or remove and replace, lightweight concrete roof insulation if surfaces are excessively scaled or too rough to receive roofing, according to roofing membrane manufacturer's written requirements.

B. Remove and replace lightweight concrete roof insulation that fails to comply with compressive-strength and oven-dry unit weight requirements.

END OF SECTION

CSECTION 03 62 00 – NON-SHRINK GROUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

A. This specification describes non-shrink epoxy grout and non-shrink cement-based grout to be used wherever shown or implied on the drawings or called for in the specifications.

1.3 SUBMITTALS

A. Product data: Submit product data for the non-shrink grout verifying the products' compliance with this specification and describing the manufacturer's placement recommendations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Non-Shrink Epoxy Grout: All epoxy grout shall be a pourable, non-shrink, 100% solids epoxy system. The epoxy grout system shall be supplied in units consisting of three components: resin, hardener, and specially-blended aggregate, all premeasured and prepackaged.

1. Resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable.

2. Variation of component ratios is not permitted unless specifically recommended by the manufacturer.

3. The non-shrink epoxy grout shall exhibit the following properties:

    a. Working life: The mixed epoxy grout system shall have a minimum "working life" of 45 minutes at 75 degrees F.
    b. Compressive Strength: The hardened epoxy grout shall attain a minimum compressive strength of 5,500 psi in 24 hours and 10,000 psi in seven days when tested according to ASTM C 579, Method B.
    c. Thermal Coefficient: The epoxy grout shall exhibit a maximum thermal coefficient of .000030 -6 in./in./Fahrenheit when tested according to ASTM C 531 or ASTM D 696.
    d. Effective Bearing Area: The epoxy grout shall exhibit a minimum effective bearing area of 95%.

B. Non-Shrink Cement-Based Grout: Non-Shrink grout shall consist of premeasured, prepackaged materials supplied by the manufacturer requiring only the addition of water. The manufacturer's instructions must be printed on the outside of each bag.

1. The non-shrink cement-based grout shall exhibit the following properties:

    a. Non-Shrink: Grout shall comply with ASTM C1107. No shrinkage (0.0 percent) and a maximum 4.0% expansion when tested in accordance with ASTM C827. No shrinkage (0.0 percent), and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C1090.
    b. Compressive Strength: A minimum 28day compressive strength of 5,000 psi when tested in accordance with ASTM C 109.
    c. Setting Time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C 191.

C. Water: Potable water.

D. Coarse Aggregate: Provide a clean, coarse aggregate conforming to ASTM C 404 (maximum size 3/8") for grout thickness greater than three inches.

2.2 MANUFACTURERS

A. Non-Shrink Epoxy Grout:

1. E³-F; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com

2. Five Star HP Epoxy Grout; Five Star Products, Inc.; 800-243-2206; www.firestarproducts.com

3. Rezi-Weld 3/2; W.R. Meadows, Inc.;800-342-5976; www.wrmeadows.com

4. MasterFlow 647; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us

5. Epoxy Grout J55; Dayton Superior; 888-977-9600; www.daytonsuperior.com

6. Polytops GC Grout; ChemMasters; 440-428-2105; www.chemmasters.net

B. Metallic Non-Shrink Cement-Based Grout

1. NS Metallic Grout; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com

2. MasterFlow 885; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us

C. Non-metallic Non-Shrink Cement-Based Grout:

1. MasterFlow 100; BASF Construction Chemicals – Building Systems; 800-722-8899; www.master-builders-solutions.basf.us

2. NS Grout; Euclid Chemical Company; 800-321-7628; www.euclidchemical.com

3. Sure-Grip Grout; Dayton Superior; 888-977-9600; www.daytonsuperior.com

4. Five Star Grout; Five Star Products, Inc.; 800-243-2206; www.firestarproducts.com

5. Crystex;L&M Construction Chemicals, Inc.; 800-362-3331; www.lmcc.com

6. Conset Grout; ChemMasters; 440-428-2105; www.chemmasters.net

7. 588-10K Nonshrink Grout; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

8. CG-86 Nonshrink Grout; W.R. Meadows, Inc.; 800-342-5976; www.wrmeadows.com

PART 3 - EXECUTION

3.1 GENERAL

A. Placing: The Contractor shall perform all mixing and placement in accordance with the manufacturer's recommendations.

B. Temperature: The temperature of the grouting surfaces and the grout shall be maintained between 50 degrees F and 90 degrees F during grouting and for a minimum of 24 hours thereafter.

C. Elimination of Voids: Grout placement shall proceed in a manner that will assure the filling of all spaces and intimate contact of the grout with contact surfaces. Grout holes shall be used; location to be approved by Architect/Engineer if not otherwise detailed.

3.2 SURFACE PREPARATION

A. Concrete Surfaces: The concrete on which the grout will bear shall have attained its design strength before grouting.

1. Concrete shall be sound and all surfaces to be in contact with the grout shall be entirely free of oil, grease, laitance, curing compounds, and other deleterious substances.

2. Surfaces shall be roughened by chipping, sandblasting or other mechanical means to assure bond of the grout to the existing concrete.

B. Metal Surfaces: All metal surfaces which are to be in direct contact with the grout shall be thoroughly cleaned to bare metal immediately before grouting. Cool down hot base plates with cold water. Heat cold base plates with hot water.

C. Adjacent Surfaces: Treat adjacent surfaces and formwork with a bond breaking material to prevent bonding of excess grout.

3.3 INSTALLATION

A. Formwork: Forms shall remain in full contact with the grout until it hardens.

1. Forms shall be watertight and capable of supporting the grout until it cures.

2. Wood forms must be sealed.

B. Non-Shrink Epoxy Grout:

1. Surface Dryness: All surfaces shall be kept completely dry before grouting.

2. Grout Removal: Surfaces from which grout is to be removed after placing shall be treated with a paste wax or release agent before placement.

C. Non-Shrink Cement-Based Grout:

1. Composition: For interior column base plates not exposed to weather, grout containing metallic particles such as aluminum powders or iron filings may be used. For any other applications, the grout shall not contain metallic particles such as aluminum powders or iron fillings or expansive cement.

2. Mixing: For grouting depths greater than three (3) inches, add 3/8" coarse aggregate to the mix following manufacturer's recommendations. Use the minimum water necessary for proper installation in accordance with flowability requirements and manufacturers recommendations for specific applications.

D. Grouting Operation: Concrete surfaces shall be washed clean, then saturated with water for 24 hours prior to placement of cement-based grout. Excess water must be removed prior to grouting. The placement of grout should be rapid and continuous so as to avoid cold joints.

1. Protect grout from external vibration caused by operating machinery for at least 24 hours.

2. Curing: Cover all exposed grout with wet burlap immediately after placement. Keep area moist for a minimum of 48 hours.

END OF SECTION 03 62 00

SECTION 04 05 03 - MASONRY MORTARING AND GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes mortar and grout for masonry.

B. Related Sections:
1. Section 04 20 00 - Unit Masonry.
2. Section 08 11 13 - Standard Steel Frames: Grouting steel door frames.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
2. ASTM C150 - Standard Specification for Portland Cement.
3. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
4. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
6. ASTM C476 - Standard Specification for Grout for Masonry.
7. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
8. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
9. ASTM C1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
10. ASTM C1357 - Standard Test Method for Evaluating Masonry Bond Strength.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Samples: Submit two samples of each type of colored mortar, illustrating mortar color and range.

C. Design Data: Submit design mix when Property specification of ASTM C270 is to be used, required environmental conditions, and admixture limitations.

D. Test Reports:
1. Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270.
2. Submit reports on grout indicating conformance of grout to property requirements of ASTM C476.
3. Include descriptions of types and proportions of mortar and grout ingredients.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

C. Preconstruction Testing Services: Provide Material Certificates in lieu of testing, unless otherwise directed by Architect. If Material Certificates are unavailable, notify the Architect

immediately upon discovery. Engage a qualified independent testing agency to perform preconstruction testing indicated below if directed by the Architect. Payment for these services will be made by the Owner except in the case of retesting for substandard materials and in the case of first time testing for substandard materials where Material Certificates were submitted as part of the Quality Control procedures for the job. Where considered appropriate by the Architect/Engineer, Prism Test shall be used where completed masonry assemblies are built with potentially substandard materials. Testing of built assemblies determined to contain substandard materials, shall be at the Contractor's expense.

D. Material Certificates (non-load bearing walls): Material Certificates proving compliance with the test below (except the Prism Test) are usually available from manufacturers. Certificates indicating compliance are acceptable to satisfy Quality Control requirements for the individual materials listed when used in masonry assemblies. Use this method of Quality Control in lieu of Prism Test unless total cost of Certificate acquisition is greater than the Prism Tests.
   1. Mortar Test (Property Specification): For each mix required, per ASTM C780.
   2. Grout Test (Compressive Strength): For each mix required, per ASTM C1019 with minimum compressive strength of 2,500 psi.
   3. Prism Tests (required for load bearing walls, conditionally allowed for non-load bearing walls): At the Contractors option, with agreement of the Architect/Engineer, Prism Tests may be used to confirm non-load bearing masonry assembly compressive strength in lieu of Material Certificates.
      a. Prism Test: For each type of reinforced wall construction indicated, per ASTM C1314.
      b. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
      d. Fabricate concrete masonry prisms with height-to-thickness ratio of not less than 1.33 nor more than 3.0.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Portland Cement: ASTM C150, Type I, gray or white color as required to produce mortar color indicated.

B. MASONRY CEMENT SHALL NOT BE USED.

C. Mortar Aggregate: ASTM C144, standard masonry type.

D. Hydrated Lime: ASTM C206, Type S.

E. Grout Aggregate: ASTM C404, fine and coarse.

F. Water: Clean and potable.

G. Mortar Color: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

1. Manufacturers:
   a. "SGS Mortar Colors"; Solomon Grind-Chem Service, Inc., www.solomoncolors.com
   b. "True Tone Mortar Colors"; Davis Colors, A Subsidiary of Rockwood Industries, Inc., www.daviscolors.com
2. Color to be selected by Architect from Manufacture's full range of options.

H. Water Repellent Admixture: Liquid water repellent mortar admixture intended for use with exterior decorative concrete masonry units containing integral water repellent.
1. Manufacturers:
   a. Mortar Tite; Addiment Inc., www.addiment.com
   b. Dry-Block Mortar Admixture; W. R. Grace & Co., www.grace.com
   c. Rheopel; Master Builders., www.masterbuilders.com
   d. RainBloc for Mortar; ACM Chemistries, Inc., www.acmchem.com

I. Calcium chloride is not permitted.

J. AIR ENTRAINING ADMIXTURES SHALL NOT BE USED.

K. ANTIFREEZING ADMIXTURES SHALL NOT BE USED.

2.2 MIXES

A. Mortar Mixes:
1. Mortar For Reinforced CMU Walls: ASTM C270, Type S using Proportion specification.
2. Mortar For Face Brick and Unreinforced CMU Walls: ASTM C270, Type N using Proportion specification.

B. Mortar Mixing:
1. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.
2. Achieve uniformly damp sand immediately before mixing process.
3. Add mortar color to achieve uniformity of mix and coloration. Limit mineral-oxide pigments to no more than 10 percent of cement content by weight.
4. Re-temper only within two hours of mixing.

C. Grout Mixes:
1. Grout for Load Bearing and Non-Load Bearing Masonry: Strength as indicated on Drawings; mixed in accordance with ASTM C476.
2. Application:
   a. Coarse Grout: For grouting spaces with minimum 4 inches dimension in every direction.
   b. Fine Grout: For grouting other spaces.

D. Grout Mixing:
1. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Request inspection of spaces to be grouted.

3.2 INSTALLATION

A. Install mortar in accordance with Section 04 20 00.

B. Low-Lift Grouting:
   1. Use Low-Lift grouting technique for all walls and bond beams.
   2. Provide minimum clear dimension of 2 inches and clear area of 8 sq. in. in vertical cores to be grouted.
   3. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.
   4. Place horizontal beam reinforced as the masonry units are laid.
   5. Lay CMU to maximum pour height. Do not exceed 5 foot height, or if bond beam occurs below 5 foot height stop pour at course below bond beam.
   6. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2 inches below top course of pour.
   7. Bond Beams: Stop grout in vertical cells 1-1/2 inches below bond beam course. Place horizontal reinforcing in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Testing Frequency:
   1. One set of prism tests for every 5,000 S.F. of completed wall area.
   2. One set of mortar tests in accordance with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength, for every 25 C.Y. mortar.
   3. One set of grout tests in accordance with ASTM C780 for compressive strength and slump, for every 25 C.Y. grout.

END OF SECTION

SECTION 04 20 00 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Face brick.
2. Standard concrete masonry units.
3. Masonry joint reinforcement.
4. Ties and anchors.
5. Embedded flashing.
6. Miscellaneous masonry accessories.

B. Related Sections:
1. Section 04 05 03 - Masonry Mortaring and Grouting: Mortar and grout.
2. Section 04 73 00 – Manufactured Stone Masonry.
3. Section 05 12 00 - Structural Steel Framing: Product requirements for steel anchors for placement by this section.
4. Section 05 50 00 - Metal Fabrications: Product requirements for loose steel lintels for placement by this section.
5. Section 07 21 13 - Board Insulation: Insulation for cavity spaces.
6. Section 07 62 00 - Sheet Metal Flashing and Trim: Product requirements for reglets for flashings for placement by this section.
7. Section 07 90 00 - Joint Protection: Rod and sealant at control and expansion joints.

1.2 REFERENCES

A. American Concrete Institute:
1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specifications for Masonry Structures.

B. ASTM International:
1. ASTM A153/A153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
4. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
5. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
6. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale).
7. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
8. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data:
1. Submit data for decorative masonry units, fabricated wire reinforcement, wall ties, anchors, cavity drainage material, and other accessories.

2. Submit data for cleaning solutions, including detailed description of methods, materials, equipment and site cleanup procedures to be used. Provide with letters of approval from brick and cleaning material manufacturers regarding the compatibility of proposed use of products together for cleaning purposes.

C. Samples:
1. Submit four samples of each type of decorative masonry unit and face brick, to illustrate color, texture and extremes of color range. Furnish additional samples when necessary to fully illustrate the complete range of highly variable materials.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

B. Fire Rated Wall Construction: Rating as indicated on Drawings.
1. Tested Rating: Determined in accordance with ASTM E119.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mockup requirements.

B. Construct cavity masonry wall mockup, 4 feet long by 4 feet high, including masonry, mortar and accessories, structural backup, flashings, wall insulation, and weeps.
1. Structural backup wall to consist of CMU and cold formed metal framing.
2. Include a sealant-filled control joint.
3. Omit masonry above flashing to leave a 12 inch length of the flashing exposed to view.
4. Clean face of mockup with masonry cleaner using methods anticipated for the work.

C. Furnish removable cover to protect completed mock-up from rain or other environmental or site conditions that may alter its appearance.

D. Locate where directed by Architect/Engineer.

E. Remove mockup when directed by Architect/Engineer.

1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept masonry units and accessories on site. Inspect for damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

D. Bracing of Work in Progress:
1. Where masonry erection may be exposed to high winds, installation shall be adequately braced until masonry construction has attained sufficient strength to resist wind forces.
2. Shores and forms shall not be removed until masonry construction has attained sufficient strength to support its own weight and all other construction or environmental loads.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with work of other trades built into or adjoining masonry work.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. **BK-1** and **BK-2 -** Velour Face Brick: ASTM C652, Grade SW, Type HBS, HBX, or HBA in accordance with the particular units selected for use, as indicated on Drawings.
1. Size: Modular. Velour finish in color(s) as scheduled.
2. Furnish special units and “solids” where indicated on Drawings, and for corners other than 90-degrees, window sills, outside corners of soldier courses, and other locations to ensure against exposed cores or unfinished faces or ends.
3. As distributed locally by Upchurch-Kimbrough, Inc.

B. Hollow Load Bearing Concrete Masonry Units (CMU): ASTM C90, lightweight type only.
1. Size: Nominal modular size of 16 inches long x 8 inches high x thickness indicated.
2. Furnish special units for bond beams and lintels.
3. Furnish bullnose corners at units exposed to interior of building.

C. Solid Load-Bearing Concrete Masonry Units (CMU): ASTM C90; size and weight to match hollow units.

D. Mortar and Grout: As specified in Section 04 05 03.

2.2 ANCHORS, TIES AND REINFORCEMENT

A. Manufacturers:
1. AA Wire Products
2. Heckman Building Products, www.heckmannbuildingprods.com
3. Hohmann & Barnard (Dur-O-Wall), www.h-b.com
4. Masonry Reinforcing Corp. of America (Wire-Bond)
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Single Wythe Joint Reinforcement: ASTM A951; ladder type; steel; 9 gage side rods and cross ties; hot dip galvanized

C. Strap Anchors: Bent steel, 1-1/2 inches wide x 24 inches long x 1/4 inch thick, with ends turned up not less than 2 inches; ASTM A153/A153M hot dip galvanized.

D. Veneer Ties for CFMF Stud Backup Walls: Rib-stiffened sheet metal plate anchors with screw holes top and bottom and projecting tabs with slotted holes for receiving vertical legs of adjustable wire ties; ASTM A153/A153M hot dip galvanized.
1. Anchor Size: 2-3/4 inches wide by 3 inches high.
2. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.

3. Tie Shape: Rectangular
4. Fasteners: Type 304 stainless steel hex-washer head screws with carbon drill point as provided by Hohmann & Barnard.
   a. Size: #12 diameter x length required to penetrate steel stud flange by not less than 3 exposed threads.
   b. Complete with stainless steel backed neoprene sealing washer.
5. Basis of Design:
   a. Running Bond Brick: Hohmann & Barnard HB-200X.
   b. Stacked Bond or Soldier Course Brick: **Hohmann & Barnard HB-213 SH or 300C/HB-213 Seismic.** Provide with hot-dip galvanized 0.1875 inch diameter wire reinforcing continuous within horizontal brick joint.

E. Veneer Ties for CMU Backup Walls: ASTM A82; ladder type joint reinforcement with adjustable eye and pintle type wire ties; ASTM A153/A153M hot dip galvanized.
1. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
2. Tie Shape: Rectangular
3. Fasteners: #12 stainless steel screws self-tapping screws.
4. Basis of Design:
   a. Modular Brick: Hohmann & Barnard, #270 Ladder Eye-Wire.
   b. King Size Brick: **Hohmann & Barnard, 2-Seal BYNA-LOK** wire tie with hot-dip galvanized 0.1875 inch diameter wire reinforcing continuous within horizontal brick joint**.**

F. Veneer Ties for Grade Beams and Concrete Backup Walls: Zinc-alloy barrel section with flanged head and eye, fastened with corrosion-resistant, self-drilling screw. Eye designed to receive tie and to serve as head for drilling fastener into concrete. Provide barrel length to suit cavity wall insulation thickness, allowing screw to seat directly against the concrete wall with flanged head covering hole in insulation.
1. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
2. Tie Shape: Triangular
3. Basis of Design: **Hohmann & Barnard, 2-Seal BYNA-LOK** wire tie.

G. Dovetail Anchors (where indicated): Bent steel strap formed from 0.1046 inch thick steel, with 0.1875 inch diameter triangular-shaped wire tie sized to extend within 1 inch of masonry face; ASTM A153/A153M hot dip galvanized.

H. Steel Beam and Column Anchors: Crimped 1/4 inch diameter wire anchor welded to steel member, with 0.1875 inch diameter triangular-shaped wire tie for solid masonry and rectangular-shaped wire tie for hollow masonry, sized to extend within 1 inch of masonry face; ASTM A153/A153M hot dip galvanized.

I. Reinforcing Steel: Type specified in Section 03 20 00.

J. Anchor Bolts: ASTM A307; Grade A; J-shaped or L-shaped; complete with flat washers and heavy hex nuts; hot-dipped galvanized finish, ASTM A153/A153M.

2.3 EMBEDDED FLASHING MATERIALS

A. Stainless Steel: ASTM A240, Type 304, soft temper; 0.016 inch thick; smooth finish.

B. Asphalt-Coated Copper Flashing: 5 oz/sq ft rolled sheet copper coated with flexible asphalt.
1. Manufacturers:
   a. Cop-A-Cote; AFCO Products, Inc., www.afcoproducts.com
   b. Type ACC-Asphalt Bituminous Coated; Phoenix Building Products.
   c. Coated Copper Flashing; Sandell Manufacturing Co., Inc., www.sandellmfg.com
   d. Substitutions: Section 01 60 00 - Product Requirements.

C. Rubberized Asphalt Flashing: Composite flashing sheet consisting of self-adhesive rubberized asphalt compound bonded to a high-density cross-laminated polyethylene film; overall thickness of 0.030 inch.
   1. Do not install rubberized asphalt flashing adjacent to or in contact with flexible vinyl or PVC products.
   2. Manufacturers:
      a. Perm-A-Barrier Wall Flashing; W. R. Grace & Co., www.grace.com
      b. Vycor V-40; W. R. Grace & Co., www.grace.com
      c. Polyguard 400; Polyguard Products, Inc., www.polyguardproducts.com
      d. Cloaked Flashing System, Hyload Inc., www.HyloadFlashing.com
      e. Substitutions: Section 01 60 00 - Product Requirements.

D. Coping Flashing: Stainless steel, soft temper; 0.016 inch thick; smooth finish; formed with dovetail ribs 3 inches on center for integral mortar bond.

E. Lap Sealant: Type specified in Section 07 90 00.

2.4 ACCESSORIES

A. Joint Filler: ASTM D1056, Grade 2A1, closed cell neoprene; oversized 50 percent to joint width; self-expanding.

B. Cavity Wall Insulation: Extruded polystyrene board specified in Section 07 21 13.

C. Cavity Drainage Material: Open polyethylene mesh thickness required to fill cavity space, and shaped to ensure moisture drainage to cavity weeps.
   1. Manufacturers:
      a. Mortar Break; Advanced Building Products Inc., www.advancedflashing.com
      b. Mortar Net; Mortar Net USA, Ltd., www.mortarnet.com
      c. CavClear Masonry Mat, Archovations, Inc., www.cavclear.com
      d. Substitutions: Section 01 60 00 - Product Requirements.

D. Weeps: Open head joints, maximum 3 inches high.

E. Cleaning Solutions:
   1. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.
   2. Proprietary Acidic Cleaner: Standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry and pigmented mortar surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
      a. Manufacturers:
         1) AHI Supply, www.ahi-supply.com.
         2) Diedrich Technologies, Inc., www.diedrichtechnologies.com.
         3) EaCo Chem, Inc., www.eacochem.com.
         4) ProSoCo, Inc., www.prosoco.com.
         5) Substitutions: Section 01 60 00 - Product Requirements.

F. Steel Lintels: Size as indicated on Drawings, hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

C. Wet clay and shale brick before laying when initial rate of absorption is greater than 30 grams when tested in accordance with ASTM C67.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

C. Lay exposed masonry in the bond pattern shown or, if not shown, lay as follows:
1. Coursing of Brick Units:
   a. Bond: Running.
   b. Coursing: Three units and three mortar joints to equal **9 inches**.
   c. Mortar Joints: Concave.
2. Coursing of Concrete Masonry Units:
   a. Bond: Running.
   b. Coursing: One unit and one mortar joint to equal 8 inches.
   c. Mortar Joints: Concave.
3. Coursing of Decorative Concrete Masonry Units:
   a. Bond: Running.
   b. Coursing: One unit and one mortar joint to equal 8 inches.
   c. Mortar Joints: Concave.
4. Coursing of Cast Stone Masonry Units: Not applicable.

D. Placing and Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
   a. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
   b. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with motor-driven saws to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Where possible, use full-size units without cutting.
8. Install cut units with cut surfaces and edges concealed.
9. Select and arrange exposed units to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
10. Cut mortar joints flush where wall tile is scheduled or bitumen dampproofing is applied.
11. Cut mortar fins protruding into cavity from back side of face brick as work progresses.
12. Isolate masonry from vertical structural framing members.
13. At full-height walls, leave a 1□ space between top of masonry and floor or roof structure above. Brace masonry from structure with 16- gauge galvanized steel angles having 4□ equal legs and 8□ lengths mechanically anchored to the floor or roof

structure and spaced not more than 4™-0□ on center.

14. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

E. Weeps and Vents: Furnish weeps and vents in outer wythe at maximum 24 inches oc horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and above other obstructions of wall cavity continuity.

F. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and bituminous dampproofing.

1. Install cavity drain material, notched end up, continuously at bottom of each cavity above embedded flashing.

G. Stain Prevention: As work progresses, 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 coverings spread 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.

H. 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 down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

3.4 JOINT REINFORCEMENT

A. Install horizontal joint reinforcement in cmu walls 16 inches oc.

B. Place joint reinforcement in first and second horizontal joints above and below openings greater than 12 inches wide. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joints below tops of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Cut or interrupt joint reinforcing at control and expansion joints.

F. At corners, install horizontal joint reinforcement with prefabricated œL□ intersections.

G. At intersecting and abutting walls, unless vertical expansion or control joints are shown at juncture, install horizontal joint reinforcement with prefabricated œT□ intersections.

H. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.5 TIES AND ANCHORS

A. Install anchors attached to concrete and steel structural members:

1. Leave an open space not less than 1 inch in width between back of masonry and face of structural member. Keep open space free of mortar or other rigid materials.
2. Install anchors at maximum 16 inches o.c. vertically and horizontally.

B. Install Wall Ties at CMU Backup Walls:

1. Install wall ties at 16 inches oc vertically and maximum 16 inches oc horizontally.
2. Coordinate ties to accommodate installation of 16 inch widths of cavity wall insulation specified in Section 07 21 13.
3. Place additional wall ties within 12 inches of openings at intervals not exceeding 36 inches.

C. Install Wall Ties at CFMF Backup Walls:
1. Install wall tie anchor plates at 16 inches oc vertically and maximum 16 inches oc horizontally.
2. Coordinate anchor plates to accommodate installation of 16 inch widths of cavity wall insulation specified in Section 07 21 13.
3. Place additional wall ties within 12 inches of openings at intervals not exceeding 36 inches.
4. Secure wall tie anchor plates through sheathing to CFMF studs.

3.6 MASONRY FLASHINGS

A. Provide concealed flashing in masonry work at or above shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior.

B. Form flashings from the following materials:
1. Exposed flashings: Stainless steel.
2. Concealed flashings: Asphalt-coated copper or rubberized asphalt, at contractor™s option.

C. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar.

D. Extend flashings horizontally through exterior face of masonry and turn down 1/4 inch to form drip.

E. Turn flashing up minimum 8 inches and bed into mortar joint of CMU backup wall or seal to sheathing over CFMF stud backup wall.

F. Lap end joints minimum 6 inches and seal watertight.

G. Extend flashing the full length of lintels and shelf angles and minimum of 4" into masonry each end; turn up ends not less than 2" to form end dams as recommended by BIA and illustrated in BIA Technical Note 7, Figure 21, current edition.

H. Turn flashing, fold, and seal at corners, bends, and interruptions.

3.7 LINTELS

A. Install loose steel lintels over openings more than 12 inches wide in brick or decorative cmu walls.

B. Install reinforced unit masonry lintels over openings more than 24 inches wide in CMU walls.
1. Reinforce lintels as indicated on Drawings.
2. Do not splice reinforcing bars.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8-inch bearing on each side of opening.

3.8 MISCELLANEOUS

A. Grouted Components:
1. Reinforce bond beams and pilasters as indicated on Drawings.
2. Splice reinforcement in accordance with Section 03 20 00.

3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.
6. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

B. Reinforced Masonry:
1. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place reinforcement bars as indicated on Drawings.
3. Splice reinforcement in accordance with Section 03 20 00.
4. Support and secure reinforcement from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.

C. Control And Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Interior Partitions: 25'-0" o.c. horizontally.
   b. Exterior Cavity Walls: 20'-0" o.c. horizontally.
   c. Steel Lintels: Provide horizontal bond breaks as detailed on Drawings at the end bearing to allow for thermal expansion and contraction.
   d. VERIFY DESIGN OF SHELF ANGLES AND PROPER COURSING WITH PROJECT ARCHITECT AND ENGINEER FOR BELOW, OR DELETE.
   e. Openings in Exterior and Interior Walls: At masonry with steel lintels, provide expansion joints on each side of the opening continuing to the top and bottom of the brick wythe and as specified above. At CMU lintels, provide control joints in alignment with the outside ends of the lintel continuing to the bed joint and then with horizontal bond breaks at the end bearing.
   f. Veneer Construction: Provide horizontal pressure relieving joints beneath shelf angles as recommended by BIA Technical Note 28B current edition.
   g. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Form expansion joint by omitting mortar and cutting unit to form open joint.

D. Built-In Work:
1. As work progresses, install built-in door and window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and window frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
5. Do not build in materials subject to deterioration.

E. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items penetrating masonry. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.9 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Alignment of Columns and Pilasters: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft; 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

I. Maximum Variation for Steel Reinforcement:
   1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
   2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
   3. Plus or minus 1 inch when distance is between 8 and 24 inches.
   4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
   5. Plus or minus 2 inches from location along face of wall.

3.10 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

F. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
   4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution, or clean masonry with approved cleaner applied according to the brick and the cleaning manufacturer's written instructions and approval.
   6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.
   7. Do not use high-pressure washing methods (greater than 700psi as described in BIA Technical Notes No. 20) on single wythe construction, on concrete masonry incorporating integral or applied water repellents, or on sand-finished face brick.

3.11 DEFECTIVE CONSTRUCTION

A. Correct defects appearing in the finished work for a period of one year after the date of Substantial Completion.

B. Defects shall include, but not be limited to, cracking, separating or color leaching of mortar, cracking, discoloration, or deterioration of masonry units, efflorescence in masonry units or

joints, and water penetration through face brick or joints under normal exposure.

3.12 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.

D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 04 29 00 - ENGINEERED UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes furnishing all labor, materials, and services incidental to the installation of steel reinforcing for CMU, brick, and stone masonry:

B. Related Sections:
   1. Section 01 40 00 – Quality Requirements: Materials testing.
   2. Section 04 20 00 – Unit Masonry Assemblies.

1.2 RELATED DOCUMENTS

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

B. Requirements of Division 4 Section "Unit Masonry Assemblies" apply to Work of this Section.

1.3 SUMMARY

A. This Section consists of furnishing all the labor, materials, and services incidental to the installation of reinforced unit masonry.

1.4 DESCRIPTION OF WORK

A. Extent of each type of reinforced unit masonry work is indicated on drawings and in schedules.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work. Submit shop drawings showing wall elevations with all masonry openings, reinforcement, and control joints.

B. Material certificates in lieu of material laboratory test reports when permitted by Architect/Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

C. Testing Reports: The independent testing laboratory shall submit laboratory test reports for materials used directly to the Architect/Engineer with copy to others in accordance with the provisions of Division 1 Section "Quality Control Services." State in each report whether or not the test specimens comply to the specified requirements and indicate any deviations therefrom.

PART 2 - PRODUCTS

2.1 UNIT MASONRY

A. General: Refer to Division 4 Section "Unit Masonry Assemblies" for masonry materials and accessories not included in this Section.

B. Masonry Compressive Strengths:

1. Minimum masonry compressive strength (Fm) = 2000 psi.
2. Concrete Masonry Units: ASTM C 90, with a minimum compressive strength of 2500 psi, minimum average of three units on the net area.
3. Mortar : ASTM C 270, Type S.
4. Grout : ASTM C 476, with a minimum compressive strength of 2500 psi.

2.2 REINFORCEMENT BARS

A. General: Provide deformed bars to following grades complying with ASTM A 615, except as otherwise indicated.

1. Provide Grade 40 for bars No. 3, except as otherwise indicated.
2. Provide Grade 60 for bars No. 4 to No. 18, except as otherwise indicated.
3. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.1 PLACING REINFORCEMENT

A. General: Clean reinforcement loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcing accurately at the spacing indicated. Support secure vertical bars against displacement. Horizontal reinforcing may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater). Minimum clearance between masonry and reinforcement shall be 1/2".

1. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1-1/2 times the nominal bar diameter or 1-1/2", whichever is greater. Provide lateral ties as indicated. Refer to the general notes on the drawings for minimum clearance between the main reinforcement and the masonry.

C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

D. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 5/8" on exterior face of walls and 1/2" at other locations.

E. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 5/8" on exterior face of walls and 1/2" at other locations. Lap units not less than 6" at ends. Use prefabricated "L" and "T" units to provide continuity at corners and

intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

F. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
   1. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

G. Foundation dowels: Dowels in the foundation shall be placed to align with cores containing reinforcement.

3.2 INSTALLATION, GENERAL

A. Refer to Division 4 Section "Unit Masonry Assemblies" for general installation requirements to unit masonry.

B. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

   1. Construct Formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar grout, or concrete (if any). Brace, tie and support as required to maintain portion and shape during construction and curing of reinforced masonry.

C. Do not remove forms and shores until reinforced masonry member have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

   1. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
      a. 10 days for girders and beams.

3.3 INSTALLATION OF REINFORCED BRICK MASONRY

A. Mortar Jointing and Bedding:
   1. Pattern Bond: Lay exterior wythes in the pattern bond shown, or if not shown, lay in 1/2-running bond with vertical joints in each course centered on units in courses above and below. Lay inner wythes (if any) with all units in a wythe bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners and intersections. Do not use units with less than 4" nominal horizontal face dimension at corners or jambs.
   2. Lay exterior wythes with bed (horizontal) and head (vertical) joints between units completely filled with mortar. Top of bed joint mortar may be sloped toward center of walls. Butter ends of units with sufficient mortar to completely fill head joints and shove into place. Do not furrow bed joints or slush head joints. Remove any mortar fins which protrude into grout space.

      a. Maintain joint widths shown for head and bed joints, but adjust thickness of bed joints, if required, to allow for not less than 1/4" thickness of mortar between reinforcement and masonry units, except 1/4" bars (if any) may be laid in 1/2" thick bed joints and No. 6 gage or smaller wire reinforcing (if any) may be laid in 3/8" thick bed joints.

B. Two-Wythes Wall Construction: Lay both wythes as previously specified for exterior wythes. Maintain grout space (collar or continuous vertical joint between wythes) of width indicated, but adjust, if required, to provide grout space not less than 1/2" wider than the sum of the vertical and horizontal (if any) reinforcement bars shown to be placed in grout space. Do not parge or fill grout space with mortar.

C. Limit extent of masonry construction to sections which do not exceed the maximum pour requirements specified hereafter. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.

D. Low-Lift Grouting:
   1. Use Low-Lift grouting technique with "Fine Grout" per ASTM C 476 for the following:
      a. Two-wythe walls with grout space of 2" or less in width.

   2. Use Low-Lift grouting technique with "Coarse Grout" per ASTM C 476 for the following:
      a. Columns, piers or pilasters where masonry units are shown in core areas enclosed by exterior masonry units.

   3. Construct low-lift masonry by placing reinforcement, laying masonry units and pouring grout as the work progresses.

   4. Place vertical reinforcement bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcement bars may be placed progressively with laying of masonry units.

   5. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 12" pour height.

   6. Lay masonry units prior to each grout pour, but do not construct more than 12" above maximum grout pour height in one exterior wythe and 4" above in other exterior wythe. Provide metal wall ties if required to prevent blowouts.

   7. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1-1/2" below top of highest course in pour.

3.4 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).

B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

   1. Where solid CMU units are shown, lay with full mortar head and bed joints.

C. Walls:

   1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

   2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimensions indicated and to provide minimum

clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

4. Columns, Piers and Pilasters:
   a. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
   b. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
   c. Lay wall and pilaster units together to maximum pour height specified.

D. Grouting:
   1. Use “Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions and bond beams.
   2. Use "Coarse Grout" per ASTM C 476 for filling 4" spaces or larger in both horizontal directions and formed beams.

E. Low-Lift Grouting:
   1. Use Low-Lift grouting technique for all walls and bond beams.

   2. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.

   3. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 ft.

   4. Place horizontal beam reinforced as the masonry units are laid.

   5. Lay CMU to maximum pour height. Do not exceed 5' height, or if bond beam occurs below 5' height stop pour at course below bond beam.

   6. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.

   7. Bond Beams: Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcing in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

F. High-Lift Grouting:
   1. High-lift grouting technique may be used for the following masonry construction:
      a. Columns, piers, pilasters, or formed beams.

   2. Provide cleanout holes in first course of each grout pour at all vertical cells which are to be filled with grout.
      a. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.

3. Construct masonry to full height of maximum grout specified, prior to placing grout.
   a. Limit grout lifts to a maximum height of 5' and grout pour to a maximum height of 12', unless otherwise indicated.

4. Place vertical reinforcement before grout placement. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 10'.
   a. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcing bar, pull loops and bar to proper position and tie free ends.

5. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

6. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.

   a. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than No. 2 bars or 8 gage wire ties spaced 16" o.c. for members with 20" or less side dimensions, and 8" o.c. for members with side dimensions exceeding 20".

7. Preparation of Grout Spaces: Prior to placement, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcing and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.

   a. Do not place grout until entire height of masonry to be poured has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.

   b. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.

   c. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 5'. Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.

   d. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section. Repeat sequence if more pours are required.

3.5 FIELD QUALITY CONTROL

A. General: An independent testing agency shall perform tests and to submit test reports.

B. Minimum Tests and Submittals:
   1. Certificate for materials used in masonry construction indicating compliance with contract documents.

2. Verification of Minimum masonry compressive strength (f'm) prior to construction and every 5000 sq. ft during construction. Perform compressive strength "Prism Test" per ASTM C1314.

3. Verification of proportions of materials and grout as delivered to the site.

4. Test mortar in accordance with the property specification of ASTM C 270 or evaluate with ASTM C 780.

5. Sample and test grout in accordance with ASTM C 1019 for each 5000 sq. ft.

C. Minimum Inspection:

1. From the masonry construction and continuously during construction of masonry, verify the following are in compliance:
   a. Proportion of site-mixed mortar and grout.
   b. Placing of masonry units and construction of mortar joints.
   c. Placement of reinforcement and connectors.
   d. Grout space prior to grouting.
   e. Placement of grout.

2. Observe preparation of grout specimens, mortar specimens, and/or prisms.

3. Verify compliance with the required inspection provisions of the contract documents and the approved submittals.

D. Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests. Reports of tests shall contain the Project identification name and number, date of test, name of testing service, mortar or grout type and class, location of mortar or grout batch in structure, design compressive strength at 28 days, mortar or grout mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests. If any breaks are below specified or expected strengths, the Testing Laboratory shall report any visible anomalies.

E. Additional Tests: The testing agency will make additional tests of in-place masonry when test results indicate specified strengths and other characteristics have not been attained in the structure, as directed by Architect/Engineer. Testing agency may conduct tests to determine adequacy of materials by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION 04 29 00

SECTION 04 73 00 – MANUFACTURED STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Manufactured Stone Masonry: Calcium silicate product; may be identified as “Cast Stone” on the drawings.
   2. Miscellaneous masonry ties, anchors, and accessories related to manufactured stone masonry.

B. Related Sections:
   1. Section 04 05 03 - Masonry Mortaring and Grouting: Mortar and grout for Cast Stone.
   2. Section 04 20 00 – Unit Masonry Assemblies.
   3. Section 07 90 00 - Joint Protection: Rod and sealant at control and expansion joints.

1.2 REFERENCES

A. American Society for Testing and Materials
   1. ASTM C73-14 – Standard Specification for Calcium Silicate Brick (Sand-Lime Brick).

B. American Concrete Institute:
   1. ACI 530 - Building Code Requirements for Masonry Structures.
   2. ACI 530.1 - Specifications for Masonry Structures.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data:
   1. Submit data for manufactured stone masonry units, fabricated wire reinforcement, wall ties, anchors, and other accessories.
   2. Submit data for cleaning solutions, including detailed description of methods, materials, equipment and site cleanup procedures to be used. Provide with letters of approval from manufacturer regarding the compatibility of proposed use of products together for cleaning purposes.

C. Samples:
   1. Submit four samples of each type of manufactured stone masonry to illustrate color, texture and extremes of color range. Furnish additional samples when necessary to fully illustrate the complete range of highly variable materials.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 Building Code Requirements for Masonry Structures and ACI 530.1 Specification for Masonry Structures.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years’ documented experience.

1.6 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mockup requirements.

B. Construct mockup minimum 4 ft. x 4 ft. unless detailed otherwise in the drawings, including masonry, mortar and accessories, structural backup, flashings, wall insulation, and weeps.
   1. Structural backup wall to consist of CMU and cold formed metal framing.
   2. Include a sealant-filled control joint.

3. Omit masonry above flashing to leave a 12 inch length of the flashing exposed to view.
4. Clean face of mockup with masonry cleaner using methods anticipated for the work.

C. Furnish removable cover to protect completed mock-up from rain or other environmental or site conditions that may alter its appearance.

D. Locate in well-lit area where approved Architect/Engineer.

E. Remove mockup when directed by Architect/Engineer, unless part of permanent construction.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept masonry units and accessories on site. Inspect for damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

D. Bracing of Work in Progress:
1. Where masonry erection may be exposed to high winds, installation shall be adequately braced until masonry construction has attained sufficient strength to resist wind forces.
2. Shores and forms shall not be removed until masonry construction has attained sufficient strength to support its own weight and all other construction or environmental loads

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with work of other trades built into or adjoining masonry work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
1. Arriscraft International, distributed by Upchurch Kimbrough Company, www.arriscraft.com.
2. U.S. Stone Industries, usstoneindustries.com
3. Substitutions: Section 01 60 00 – Product Requirements.

B. Manufactured Stone Masonry Units: ASTM C1364, architectural manufactured stone masonry units fabricated by dry casting methods, with fine grained texture, simulating natural cut stone.

1. Type: Calcium silicate masonry units meeting requirements of ASTM C73, Grade SW; solid units that have been pressure-formed and autoclaved to standard and special shapes.
2. Size(s): As indicated in the drawings.
3. Reinforce units as indicated and as required by ASTM C1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of material.
4. Curing: Cure units to develop concrete quality, and to minimize appearance blemishes including non-uniformity, staining, or surface cracking.
5. Colors and Textures: As scheduled.
6. Mortar Color: As selected by the Architect.

2.2 ANCHORS, TIES AND REINFORCEMENT

A. Manufacturers:
1. AA Wire Products
2. Heckman Building Products (Dur-O-Wall), www.heckmannbuildingprods.com
3. Hohmann & Barnard, www.h-b.com
4. Masonry Reinforcing Corp. of America (Wire-Bond)
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Strap Anchors: Bent steel, 1-1/2 inches wide x 24 inches long x 1/4 inch thick, with ends turned up not less than 2 inches; ASTM A153/A153M hot dip galvanized.

C. Veneer Ties for CFMF Stud Backup Walls: Rib-stiffened sheet metal plate anchors with screw holes top and bottom and projecting tabs with slotted holes for receiving vertical legs of adjustable wire ties; ASTM A153/A153M hot dip galvanized.
1. Anchor Size: 2-3/4 inches wide by 3 inches high.
2. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
3. Tie Shape: Rectangular
4. Fasteners: Steel drill screws, #10 diameter x length required to penetrate steel stud flange by not less than 3 exposed threads, complying with ASTM C954 except with hex washer head and neoprene washer, cadmium-plated.
5. Basis of Design: Hohmann & Barnard HB-200/DA-213.

D. Veneer Ties for CMU Backup Walls: ASTM A82; ladder type joint reinforcement with adjustable eye and pintle type wire ties; ASTM A153/A153M hot dip galvanized.
1. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
2. Tie Shape: Rectangular
3. Basis of Design: Hohmann & Barnard, #270 Ladder Eye-Wire.

E. Veneer Ties for Grade Beams and Concrete Backup Walls: Zinc-alloy barrel section with flanged head and eye, fastened with corrosion-resistant, self-drilling screw. Eye designed to receive tie and to serve as head for drilling fastener into concrete. Provide barrel length to suit cavity wall insulation thickness, allowing screw to seat directly against the concrete wall with flanged head covering hole in insulation.
1. Tie Size: 0.1875 inch diameter wire, length as required to extend to within 1 inch of veneer face.
2. Tie Shape: Triangular
3. Basis of Design: Heckman Building Products, Pos-i-Tie.

F. Dovetail Anchors: Bent steel strap formed from 0.1046 inch thick steel, with 0.1875 inch diameter triangular-shaped wire tie sized to extend within 1 inch of masonry face; ASTM A153/A153M hot dip galvanized.

G. Steel Beam and Column Anchors: Crimped 1/4 inch diameter wire anchor welded to steel member, with 0.1875 inch diameter triangular-shaped wire tie for solid masonry and rectangular-shaped wire tie for hollow masonry, sized to extend within 1 inch of masonry

face; ASTM A153/A153M hot dip galvanized.

2.3 EMBEDDED FLASHING MATERIALS

A. Stainless Steel: Reference Section 07 62 00 Sheet Metal Flashing and Trim for material requirements.

B. Flexible Flashing: Reference Section 07 11 00 Dampproofing and Flexible Flashing.

C. Pre-Coated Galvanized Steel or Aluminum Sheet: Not allowed for embedment in masonry walls.

D. Galvanized or Precoated Steel Sheet: Not allowed for embedment in masonry walls.

2.4 ACCESSORIES

A. Expansion Joint Filler: ASTM D1056, Grade 2A1, closed cell neoprene; oversized 50 percent to joint width; self-expanding.

B. Weeps: Open head joints, maximum 3 inches high.

C. Cleaning Solutions:
1. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.
2. Proprietary Acidic Cleaner: Standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry and pigmented mortar surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
3. Manufacturers:
   a. AHI Supply, www.ahi-supply.com.
   b. Diedrich Technologies, Inc., www.diedrichtechnologies.com.
   c. EaCo Chem, Inc., www.eacochem.com.
   d. ProSoCo, Inc., www.prosoco.com.
   e. Substitutions: Section 01 60 00 - Product Requirements.

D. Steel Lintels: Size as indicated on Drawings, hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive manufactured stone masonry work.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

3.3 INSTALLATION

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform

thickness.

C. Placing And Bonding:
1. Lay solid manufactured stone masonry units in full bed of mortar, with full head joints.
2. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
3. Remove excess mortar as work progresses.
4. Do not shift or tap units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
5. Perform job site cutting of units with motor-driven saws to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Where possible, use full-size units without cutting.
6. Install cut units with cut surfaces and edges concealed.
7. Select and arrange exposed units to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

D. Weeps and Vents: Furnish weeps and vents in outer wythe at maximum 24 inches oc horizontally above through-wall flashing, above shelf angles and lintels, at bottom of walls, and above other obstructions of wall cavity continuity.

E. Stain Prevention: As work progresses, 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 coverings spread 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.

F. Protection of manufactured stone masonry units: 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.

3.4 TIES AND ANCHORS

A. Install anchors attached to concrete and steel structural members:
1. Leave an open space not less than 1 inch in width between back of masonry and face of structural member. Keep open space free of mortar or other rigid materials.
2. Install anchors at maximum 16 inches o.c. vertically and horizontally.

B. Install Wall Ties at CMU Backup Walls:
1. Install wall ties at 16 inches oc vertically and maximum 16 inches oc horizontally.
2. Coordinate ties to accommodate installation of 16 inch widths of cavity wall insulation specified in Section 07 21 13.
3. Place additional wall ties within 12 inches of openings at intervals not exceeding 36 inches.

C. Install Wall Ties at CFMF Backup Walls:
1. Install wall tie anchor plates at 16 inches oc vertically and maximum 16 inches oc horizontally.
2. Coordinate anchor plates to accommodate installation of 16 inch widths of cavity wall insulation specified in Section 07 21 13.
3. Place additional wall ties within 12 inches of openings at intervals not exceeding 36 inches.
4. Secure wall tie anchor plates through sheathing to CFMF studs.

3.5 EMBEDDED FLASHINGS

A. Flexible Flashings: Ensure flexible flashing is properly installed at or above shelf angles,

lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior through masonry weep openings.

B. Sheet Metal Flashings: Coordinate with Division 7 section Sheet Metal Flashing and Trim for sheet metal flashings to be built-in to masonry work. Only specified stainless steel is approved to be built-in to masonry work unless otherwise specifically approved in writing by the Architect.

C. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar.

D. Extend flexible flashings horizontally to exterior face of masonry and neatly trim flush below weep holes.

E. Extend stainless steel flashings horizontally through exterior face of masonry and turn down to form counterflashing to roofing flashing or other flashing materials as indicated in the drawings. .

F. Turn flashings up minimum 8 inches and bed into mortar joint of CMU backup wall. Ensure that vertical leg of flexible flashings are properly sealed to sheathing over CFMF stud backup wall.

G. Lap end joints of flashings minimum 6 inches and seal watertight.

H. Ensure flashings are extended the full length of lintels and shelf angles and minimum of 4" into masonry each end; turn up ends not less than 2" to form end dams as recommended by BIA and illustrated in BIA Technical Note 7, Figure 21, current edition.

I. Turn flashings, fold, and seal at corners, bends, and interruptions.

3.6 LOOSE LINTELS

A. Install loose steel lintels for manufactured stone masonry unis for openings more than 12 inches wide.

B. Maintain minimum 8 inch bearing on each side of opening.

3.7 MISCELLANEOUS

A. Control and Expansion Joints: Continue masonry control and expansion joints through manufactured stone masonry units.

B. Built-In Work:
1. As work progresses, install built-in door and window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and window frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
5. Do not build in materials subject to deterioration.

C. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items penetrating masonry. Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain Architect/Engineer’s approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with cleaning solution.

E. Use non-metallic tools in cleaning operations.

3.9 DEFECTIVE CONSTRUCTION

A. Correct defects appearing in the finished work for a period of one year after the date of Substantial Completion.

B. Defects shall include, but not be limited to, cracking, separating of mortar, cracking, discoloration, or deterioration of masonry units, efflorescence in masonry units or joints, and water penetration through manufactured stone masonry or joints under normal exposure.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect exposed external corners subject to damage.

C. Protect base of walls from mud and mortar splatter.

D. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

E. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when work is not in progress.

END OF SECTION

SECTION 05 12 00 - 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. Field-installed shear connectors.
3. Shop and Field Welding.
4. Galvanizing.
5. Prime Painting.

B. Related Requirements:
1. Section 03 62 00 “Non-Shrink Grout” for structural steel bearing and base plate connections.
2. Section 05 21 00 “Steel Joist Framing” for field installation of joists on supporting steel.
3. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
4. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
5. Section 05 12 13 “Architecturally Exposed Structural Steel” for critical exposed steel member requirements (refer to S0002 for additional information).

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. 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.

C. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

D. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

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. Pre-installation Conference: Conduct conference prior to any work beginning by trade. Time, date and location as determined by a construction manager.

1.6 ACTION SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections. In addition to Division 1 requirements, provide one half-size hard copy (paper) of any drawings submitted in the electronic files.

B. Product Data: For each type of product.

C. Shop drawings prepared under supervision of a Registered Professional Structural Engineer licensed in the state in which the project is constructed, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
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 pre-tensioned and slip-critical, high-strength bolted connections.
5. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other Sections.
6. Original contract documents shall not be reproduced for use as a portion of the Shop Drawings.
7. Indicate locations and dimensions of protected zones.
8. Identify demand critical welds.

D. 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 whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

E. 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.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, 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, and country of origin (must be domestic, including Canada).

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. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

A. Source Limitations:
1. Steel shapes shall be domestically milled and manufactured. Foreign milled steel shall not be used.
2. To the greatest extent possible steel shapes shall be manufactured with recycled material and shall be manufactured locally or within the State of Texas.

B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
1. Fabricators not meeting the requirements noted above may be submitted for consideration in writing as a substitution request DURING BIDDING PHASE ONLY. Refer to Section 4.1 for substitution request requirements. This request will be evaluated on a case-by-case basis and is subject to Owner approval.

C. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Steel Erector, CSE.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
2. If recertification of welders is required, retesting will be Contractor's responsibility.

3. 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 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

F. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary to reconfirm any non-compliance of original work and to show compliance of corrected work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast in place concrete or masonry, in ample time to not to delay work.

C. 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.

D. 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 re-lubricate 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 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. Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.

a. Promptly notify Architect/Engineer whenever design of members and connections for any portion of structure are not clearly indicated.

2. Use Allowable Stress Design; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M, Grade 50 or ASTM A572 Grade 50.

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

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

D. Baseplates: ASTM A572 Grade 50

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

F. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
1. Finish: Black except where indicated to be galvanized.

G. Welding Electrodes: Comply with AWS requirements.

2.3 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. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.

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

1. Finish: Hot-dip or mechanically deposited zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Unheaded Anchor Rods: ASTM F 1554, Grade 36, 55 (S1) & 105

1. Configuration: Straight, unless otherwise indicated.
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, unless otherwise indicated on the Contract Documents.

G. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Plain, unless otherwise indicated on the Contract Documents.

H. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain, unless otherwise indicated on the Contract Documents.

I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

L. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint, as specified in Division 5 section "Teflon Bearing Pads".

2.4 PRIMER

A. Primer: Exposed structural steel shall comply with Section 099000 "Painting and Coating."

B. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

A. Grout for use under steel bearing or base plates shall be a high strength, non-bleeding, non-shrink grout of high durability, as specified in Division 3 section "Non-shrink Grout".

2.6 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 1, "Solvent Cleaning" and SSPC-SP 2, "Hand Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. 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.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, unless otherwise indicated on the Contract Documents.
2. All bolts shall have threads excluded from the shear plane.
3. Torque wrenches shall be used to tighten high strength fasteners unless prior written approval has been obtained from the Architect/Engineer.
4. If for any reason a high strength bolt has to be removed after being stressed to "Proof Load", it shall not be reused.

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. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 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.

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 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast 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 2 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. 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. Structural steel delivered to the job site showing evidence of rust, mill scale, spatter, slag or flux deposits shall be either returned to the shop for proper cleaning and repriming, or sand blasted clean and reprimed at the job site.

2.9 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.

B. Minimize distortion and warpage of steel members being galvanized by following recommendations according to ASTM A 384/A 384 M.

1. Do not apply galvanizing using double- dip or progressive processes without Architect’s or Engineer’s written approval.
2. Galvanize lintels and exposed plates, angles, tubes, shelf angles and rolled shapes attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. General: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1. Promptly remove and replace materials or fabricated components that do not comply.

B. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

2. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

A. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."

1. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.

B. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M. In addition to visual inspection, provide non-destructive testing as indicated by AISC 360 and the contract documents, whichever is more stringent. Test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

C. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 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. Shoring shall have the effect of being continuous down to foundation level unless written approval is obtained from Architect/Engineer to do otherwise. Point loads from shoring shall be distributed to main structural members as necessary to prevent localized overstressing of supporting members. 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.

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

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

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack 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. Cranes or other erection machinery shall not be permitted on the foundation slab. The construction shall be scheduled so the structural steel is not erected from the foundation slab.

E. 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.

F. Splice members only where indicated. Splices will be permitted only with prior written approval of the Architect/Engineer.

G. Do not use thermal cutting during erection for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect/Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

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

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

J. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.

1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened, unless otherwise indicated on the Contact Documents.

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.
4. Where fillet welding of members thicker than one half inch is indicated on the drawings, preheating of members shall be accomplished as directed by the Testing Laboratory prior to welding.
5. Where one of the members is embedded in concrete, extreme care shall be taken not to overheat the concrete so as to cause cracking or spalling. Adequate time shall be allowed between multiple passes to allow cooling of the concrete adjacent to the welded members.

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. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

D. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."

1. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.

E. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, provide non-destructive testing as indicated by AISC 360 and the contract documents, whichever is more stringent. 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.

F. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

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. Field Rusting: Special steps shall be taken after erection of steel members to prevent rusting. Any rust appearing on any structural member shall be removed by wire brushing, sand blasting, or other approved techniques. The area shall then be repainted per above. This process shall be continued until the steel member is enclosed in its final waterproof or architectural covering. The Contractor shall notify the Architect/Engineer so that all structural steel may be inspected not more than 36 hours prior to attachment of blocking, sheathing, and/or other covering materials.

PART 4 - SUBSTITUTION REQUESTS

4.1 STRUCTURAL STEEL FABRICATORS

A. The following items are required to be inspected by the Owner's special inspection laboratory (or their subcontractor) at the expense of the Contractor if specification section 051200 – Structural Steel Framing (1.8.B Quality Assurance – Fabricator Qualifications) cannot be met:

1. Direction and Leadership

Management review requirements will be defined by the Fabricator and include a specific method to obtain, appropriately assess and analyze, and then report the following:

- Results of internal and external audits
- Customer feedback (surveys, letters of recognition, personal interviews, etc.)
- The level of qualification training of personnel
- Channels for communication to address and resolve all quality issues
- Product nonconformance of manufactured product (in process or final)

2. Personnel

Name and title of qualified management team assigned to the project including (but not limited to):

- Management representative
- Detailing manager (minimum three years experience)
- Purchasing manager (minimum three years experience)
- Fabrication process manager (minimum three years experience)
- Quality assurance (minimum five years experience)
- Quality control manager (minimum five years experience)
- ASNT-TC-1A certified staff (minimum one of each on staff or available under contract)
  - Certified Level II technician for each NDT method performed in shop

3. Facility

A fabrication facility shall consist of areas and buildings that provide space for the routine functions considered to be part of steel fabrication. The areas and buildings shall be conducive to achieving a consistent high quality of work meeting the requirements of the contract documents.

4. Fabrication Process Equipment

The fabricator shall have under their control the equipment and software necessary to perform the functions common to fabrication consistent with the specifications and standards common to the work being performed and consistent with meeting the requirements of the contract documents.

5. Documentation Requirements

The Quality Management System documentation shall include (but not be limited to) and be signed/dated by the highest ranking organizational individual responsible for the facility:

- A Quality Manual
  - Applicable reference documents
  - Industry and government regulations, codes and contract requirements
  - Organizational chart describing responsibility, authority and interrelationship of functional positions that manage, perform and verify work regarding quality
  - Job descriptions and required qualifications for key personnel and functions
  - Facility plan
  - Equipment list (including maintenance records)
  - Established documented procedures
  - Description of the interaction and communication between the processes of the Quality Management System used by the Fabricator to produce products of the required quality
- A statement of a quality policy and quality objectives
- Procedures and their associated Quality Records

6. Contract and Project Specification Review and Communication

The fabricator shall develop a documented procedure for contract and project specification review. The procedure shall require that a contract and project specification review be completed for each structural steel project performed. The review shall begin no later than the fabricator's acceptance of responsibility for performing the work.

The review shall identify, determine, plan, and record the specific project requirements as well as define distribution of the recorded specific project requirements to the responsible individuals in the fabricator's organization. This review will consider any issue that affects the fabricator's capability to perform the work.

The procedure shall provide for review of the original contract documents, revised contract documents and changes received through clarification (e.g. requests for information or other sources) to assure that the fabricator fully understands the contract requirements. Evidence of contract review can take the form of technical summaries, signoffs, change orders, schedules and allocation of adequate resources.

7. Design and Detailing

The shop and erection drawings produced shall incorporate all customer requirements, specifications, codes, and relevant standards to adequately procure materials, fabricate, and erect the structural steel frame and provide in instructions to the erector for location of shipping pieces in the completed structure.

To ensure and verify this, a documented procedure for preparation of shop and erection drawings shall be developed, which describes:

- How project requirements are reviewed and incorporated.
- How the fabricator coordinates, clarifies, resolves, and tracks information with the Customer (e.g., construction change documents, Requests for Information [RFI]) and how the associated resolutions are tracked and controlled).

For products that are standard components, the manufacturer shall have on file and available to the customer a set of design calculations reviewed and stamped by a professional engineer to signify that the designed product meets the current applicable code requirements for its intended use. Any design tables or design processes published with the product literature shall also be reviewed and stamped by a professional engineer. Shop drawings for these components shall include a statement that the component details are based on designs that have been reviewed and stamped by a professional engineer and are on file with the manufacturer.

For products that are job-specific, the manufacturer shall retain the services of a professional engineer to review and stamp the site-specific design of the component. The engineer shall also review the shop drawings produced for the component and verify their consistency with the design. The results of this review shall be indicated on the component shop drawings.

8. Detailing Standards

The fabricator will prepare and utilize detailing standards describing technical preferences and requirements customarily used in the shop. These standards will show special information required on advance bills such as allowances for cuts, camber, or supplementary requirements. The detailing standards will include how mill order lists are prepared which, at a minimum, include:

- Sizes and quantities
- Appropriate ASTM specification references
- Special ordering information
- Any allowances or tolerances

The detailing standards shall describe the fabricator's preferred methods of drawing layout, including but not limited to:

- Sections and views
- Title block information
- Piece marking system
- Dimensional preferences
- Commonly used shop abbreviations
- Showing bolt placement lists (including bolt type and installation requirements)
- Information required on weld symbols including any special NDT requirements

The detailing standards shall describe the fabricator's preferred method for:

- Selection of connection geometry and material (including sizes and specifications)
- Detailing holes, fasteners, washers, cuts, and copes
- Assignment of appropriate welding symbols (shop and field welds)
- Selecting bolt type and installation method
- Showing surface preparation (including specification of surface finish)
- Designating coating requirements (including coating materials and dry film thickness)
- Showing any necessary special instructions to fabricate and erect the structural steel frame

9. Shop and Erection Drawings

The fabricator shall develop a documented procedure to provide for checking of all shop and erection drawings and to describe the approval method used to release shop drawings for fabrication.

10. Checking of Shop and Erection Drawings

The documented procedure for checking of shop and erection drawings shall describe the method by which the fabricator or its subcontractor performs and records final check of shop and erection drawings to ensure compliance with contract documents before release for fabrication and erection. Such methods may include signatures, stamps, logs, files, or lists. Records shall provide means for identification of the individual checker who performed the final check of each shop or erection drawing. When detailing is performed by a subcontractor, the procedure will define the extent of review by detailing management and checking of received detailing products before release for fabrication.

11. Approval of Shop Drawings

The procedure for checking of shop and erection drawings shall describe the method used to document approval of shop drawings released for fabrication. Such methods may include signatures, stamps, logs, files, or lists. The method shall have provisions for recording Owner's designated representatives for design and construction approval of shop drawings—whether produced in house or by a subcontractor. The procedure shall require that waiver of approval from the Owner's designated representative for design or from the Owner's designated representative for construction be in writing.

12. Detailing Resource Material

The fabricator shall maintain as a minimum, a library of the required references as follows:

- AISC Steel Construction Manual, which includes the following specifications, codes, and standards:
- AISC Specification for Structural Steel Buildings
- RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts
- AISC Code of Standard Practice for Steel Buildings and Bridges
- ANSI/AWS D1.1 Structural Welding Code–Steel
- AISC Selected ASTM Standards for Structural Steel Fabrication

13. Detailing Management

Responsibilities for personnel performing detailing management shall include:

- Overseeing the production of shop and erection drawings
- Liaising with designers
- Scheduling
- Developing and maintaining company detailing standards and detailing procedures
- Transmittals related to Owner's designated representative for design and construction approvals and connection consultation subcontracting
- Coordinating and incorporating construction requirements
- Training detailers and checkers

Qualification requirements for detailing management personnel shall include one or more of the following:

- Experience in detailing and checking shop and erection drawings that have met the approval of the Owner's representative for design for a variety of structures representative of projects the company provides. The fabricator shall determine and describe a way to demonstrate competence.
- Graduate engineer with experience related to structural steel fabrication.
- Licensed P.E. or S.E., with experience related to structural steel fabrication.

14. Connection Consultation

Qualification requirements for personnel providing connection development guidance to detailers performing connection detailing shall include one or more of the following:

- Experience in connection development and in detailing and checking of shop and erection drawings for steel that have met the approval of the Owner's representative for design for a variety of structures representative of projects the company provides. The fabricator shall determine and describe a way to demonstrate competence.
- Graduate engineer with experience related to structural steel fabrication.
- Licensed P.E. or S.E., with experience related to structural steel fabrication.

In lieu of employed staff personnel, subcontractors may be used for the following functions: detailing, connection consultation, checking of shop and erection drawings, training of detailers and checkers. However, the fabricator retains the responsibility for compliance.

15. Control of Quality Records

The fabricator shall develop a documented procedure for quality records that provides for:

- Identification, collection, storage, maintenance, retention, and disposition

All quality records shall be legible and shall be stored and retained in such a way that they are retrievable from facilities that provide a suitable environment to prevent damage, deterioration or loss. Quality records typically include, but are not limited to:

- Inspection records, NDT reports, drawing logs, MTRs, C of Cs, design changes, RFIs
- Contract review, contract clarifications, design change records, including contract construction changes and addendums
- Mill and consumable purchase orders, records or summaries of nonconformance reports
- Corrective action requests, training records, subcontractor and supplier evaluations
- Internal and external quality management system audits

Retention times shall be established and recorded for records retained for any purpose. The retention periods will be at least long enough to permit evaluation of the records during the course of project construction.

16. Purchasing Data

The fabricator shall clearly describe subcontracted work and the purchased products, materials, and services ordered in written purchasing documents. This shall include but not be limited to:

- The type of service, material, class, grade, and other unique identification.
- The applicable specifications, drawings, process requirements, and inspection instructions and any witness points.
- Delivery instructions and date.
- Required C of Cs, MTRs, and NDT reports.

Purchasing documents for materials furnished to ASTM specifications shall include the information required in the *"Order Information"* section of the ASTM Standard.

17. Verification of Purchased Product, Materials and Services

The fabricator's procedure for purchasing shall define the extent of control necessary to conform to the project requirements. This may be dependent upon the type of product, the impact of subcontracted product on the quality of the final product or the records available for the demonstrated capability and performance of previous projects. Test reports, C of Cs, or other evidence of quality control shall be kept on file as defined in the fabricator's procedure requirements.
The Owner and/or Owner's representative shall be allowed the right to verify the conformance of the final product to the project requirements at the fabricator's premises.

18. Material Identification

The documented procedure shall describe how the fabricator marks or maintains the identification of base materials from the point of receipt to the point of the first fabricating operation (or beyond, if required; see Section 11.2) to assure incorporation of the correct materials into the product.

- Structural steel material shall be identified as stated in contract documents.
- Welding consumables shall be identified in accordance with the appropriate ANSI/AWS specification.
- Coating materials (excluding metallic coating) shall be identified on the container by, at a minimum, color (pigment description and federal standard number, or manufacturer's number), lot/batch number, ID/stock number, quantity of coating in container, date of manufacture, date of expiration, and manufacturer's name and address.
- Metallic coatings shall be identified by, at a minimum, composition and the appropriate ASTM specification, including hot dip or mechanical galvanizing and metallizing.
- Fasteners shall be stored in containers clearly identified by type, grade, size and lot number(s).

Records that provide a basis for material identification (e.g., MTRs and C of Cs for base materials, fasteners, welding consumables, and coatings) shall be filed and retained as defined in the fabricator's documented procedures.

19. Fabrication Process Control

The fabricator shall develop documented procedures for process control necessary to produce a consistent acceptable level of quality of the furnished product in accordance with the applicable codes or specifications. Fabrication processes include (but are not limited to) thermal and mechanical cutting, fitting and assembly, welding, drilling, bolting, milling, and coating. The fabricator will include additional “special procedures” that cover fabrication processes done at the facility (e.g., cambering).

20. Welding

The fabricator’s welding procedure shall include (but not be limited to):

- WPSs (in close proximity to and used by the welders)
- Preheat requirements
- PQRs (when required)
- Welder, welding operator, and tack welder qualifications and qualification test records
- Welder, welding operator, and tack welder performance records - to provide objective evidence that the “period of effectiveness” has not been exceeded for welder, welding operator, and tack welder qualifications
- Traceability of welds to the welders who produce them

21. Bolt Installation

The fabricator’s documented bolting procedure shall include storage, rotational capacity testing, pre installation verification, installation, and inspection of fastener assemblies for snug-tightened, pretensioned and slip-critical joint types. The documented procedure shall meet the requirements of the RCSC *Specification for Structural Joints Using High-Strength Bolts*.

22. Equipment Maintenance

The fabricator shall develop a documented procedure defining an equipment maintenance program to produce the required quality. The procedure shall define preventative maintenance for, at minimum, equipment critical to product quality and delivery requirements.

23. Inspection and Testing

The fabricator shall develop a documented procedure for inspection and testing activities to verify that the product quality meets the project requirements. The inspection and testing procedure shall define receipt, in-process, and final inspection of all product furnished to a project. Product determined during inspection and testing to be nonconforming shall be addressed by the fabricator’s nonconformance procedure.
For each type of inspection less than 100 percent, the procedure shall describe the methods for establishing sampling plans and for adjusting the level and frequency of inspection to assure expected contract quality. The fabricator’s methods will adjust the level and frequency of inspection at any time the required level of quality is not met. The level or frequency of an inspection sampling plan shall not be zero where a nonconformance has been identified and corrective action has not been fully implemented and verified as effective.

24. Assignment of QC Inspections and Monitoring

The inspection procedure shall define inspection and testing and the required records to meet the project requirements and shall assign QC inspection and QC monitoring duties.
Qualification requirements for QC inspectors shall be defined and documented. QC inspectors shall be assigned on the basis of qualification, evidenced by experience, training, and education. Qualification standards and certifications granted by recognized industry organizations related to structural steel fabrication can be used as a basis for qualification. QC inspectors shall be periodically monitored by QA (either by repeating the QC duties or by witnessing their work).
Production personnel shall be assigned to QC inspection duties under the following conditions:

- They shall be trained both in knowledge and practice in proper inspection methods and acceptance criteria specified for the material they are inspecting.
- They are aware of their responsibilities and are given time to perform their inspection responsibilities.
- They do not inspect their own work.
- Their inspections are monitored by qualified QC personnel.

25. Inspection Procedure

The fabricator's procedure shall include (but not be limited to) provisions for the following:

- Material Receipt Inspection:
  Materials received shall be compared to the purchase order requirements. The receiver shall identify the material, grade, and quantity and look for visible shipping damages. The receiver shall inspect shapes and plates for obvious deviations from the requirements of purchase order specifications.

- In-process Inspection:
  The fabricator shall conduct in-process inspection. In-process inspection plans and practices will provide a level of compliance assurance for specified process requirements and inspection acceptance criteria that are not verifiable at final inspection or that can hinder assembly. In-process inspection is appropriate for welds that will be hidden or out of reach during the final inspection, visual examination of fit-up tolerances that will not be visible after welding, areas requiring coatings that will not be accessible during final inspection. Materials shall be inspected for specification and grade, workmanship, and tolerances using appropriate codes, standards, or a documented plan before fabrication begins. Compliance with documented bolting procedures and welding procedures (WPSs, preheat and welding personnel qualifications) shall be monitored. Production personnel should be capable of inspecting the product or subassembly before sending it to the next process.

- Final Inspection:
  The fabricator shall conduct final inspection. QC inspectors qualified and responsible for final inspection shall perform the final inspection of structural steel products after the fitting, welding, and coating operations, but prior to delivery. Qualification requirements for personnel performing final inspection shall be defined and documented. Competency of staff-employed and subcontracted individuals performing final inspection shall be verifiable and evidenced by experience, training, and education.

- Inspection Records:

The inspection procedure shall indicate what records and marks are used to document inspections. In-process inspections shall be verifiable until the final inspection of the piece. Final inspections shall be documented. The quality records produced shall be filed and retained as defined in the fabricator's procedure. Inspection records shall clearly show the products and product aspects that were inspected and who performed the inspection.

26. Calibration of Inspection, Measuring and Test Equipment

The Fabricator shall develop a Documented Procedure to control, calibrate, and maintain inspection, measuring, and test equipment used to demonstrate the compliance of products and processes to the specified requirements. Tools with devices for measuring properties of fabricated pieces or process variables are included in this requirement when they are used to demonstrate the compliance of products and processes to the specified requirements.
The documented procedure shall define equipment calibration frequency. However, the volt/amp meters used to verify compliance with WPS parameters (may be welding machine volt and amp meters or auxiliary volt/amp meters) shall be calibrated whenever the accuracy of the meter is in question and at a minimum every twelve months.
Inspection, measuring and test equipment shall be used in a manner consistent with the required measurement. The precision capability of the equipment used shall support reliable determination of compliance with acceptance criteria. When specifically required, technical data pertaining to the measurement equipment shall be made available for verification that the measuring equipment is performing properly.
For inspection, measuring, and test equipment used to demonstrate the compliance of products and processes to the specified requirements, the documented procedure shall include (but not be limited to):

- An equipment list that provides a means for unique identification of each piece of equipment
- Service use for each piece of equipment including the required precision for the types of inspections, measurements or tests made
- Handling, preservation, and storage of inspection, measuring, and test equipment to maintain accuracy and fitness for use
- Calibration frequency for each piece of equipment based upon service use, requirements of this standard, manufacturer's recommendations, project requirements, specification requirements
- Identification of standards or certified equipment having a known valid relationship to internationally or nationally recognized standards used to calibrate each listed piece of equipment. Where such standards do not exist, the basis used for calibration shall be documented
- The calibration procedure for each piece of equipment calibrated at the fabricator's facility
- The calibration accuracy acceptance criteria for each piece of equipment
- The action to be taken when equipment does not meet the calibration requirements. This action includes disposition of the measuring device and an evaluation of the impact to product that was measured using the device.
- Calibration quality record maintenance as defined in the fabricator's procedure
- Method of preventing inadvertent use of equipment that is not calibrated where calibrated equipment is required

27. Control of Nonconformances

The fabricator shall develop a documented procedure to identify and control nonconformances. These nonconformances may be identified by the fabricator's inspection program, process monitoring, and during internal and external audits, which are then addressed by the corrective action procedure.

28. Nonconforming Product

Nonconforming product shall be documented to ensure that final product not conforming to specified requirements is prevented from reaching the customer. This procedure shall provide for identification, documentation, evaluation, segregation (when practical), treatment of nonconforming product, and for notification of the relevant functions concerned. Nonconforming product shall be clearly marked as soon as practical after it is discovered. Records shall be kept of the pieces affected, the nature of the nonconformance, the treatment selection, authorization, and reinspection results if applicable.
The responsibility for review, authority, and required qualifications for the personnel selecting treatment of nonconforming product shall be defined by the procedure. If the treatment is rework or repair, the result will be inspected per drawing, specification, project requirements, and the fabricator's inspection procedure. The treatment of nonconforming product may be:

- Reworked
- Repaired
- Use as is (after more detailed analysis or acceptance by the fabricator's engineering or management)
- Customer-approved nonconforming product
- Scrapped

Approval from the Owner's designated representatives for design and construction may be required by contract for treatment of nonconformances. These approvals shall be in writing for treatments resulting in "use as is," "repaired," or "reworked."

29. Corrective Action

The fabricator shall develop a documented procedure for corrective action. Any corrective action taken shall be to the degree appropriate to the magnitude of problems and commensurate with the risks to product quality.
The corrective action procedure shall include periodic review of records or summaries of nonconformances and of internal and external quality audit reports for determination and initiation of corrective actions. Corrective action may be applied when:

- There is a nonconformance that is repetitive in nature. This can be identified by periodically reviewing nonconformance reports or summaries for negative trends
- Process nonconformances are found during the internal and external quality audits indicating that the quality management system may not be implemented and functioning as stated in the quality manual
- Nonconformance with the quality management system is found during the day-to-day execution of the system
- Nonconformance is unacceptable due to cost or severity
- A customer complaint has been received
- A complaint has been received from an owner, general contractor or erector

The Corrective Action Procedure shall address these steps:

1. Document a Corrective Action Request (CAR) that includes the nonconformance to be addressed by the corrective action and the requirement that has not been met. The corrective action procedure shall define the functional positions authorized to issue a CAR and initiate the corrective action process.
2. Assign responsibility and establish a timeframe for the response to a CAR.
3. Investigate and document the scope of the nonconformance, root causes, corrective measures taken, and list the actions to be taken to prevent recurrence.
4. Communicate the CAR and resolution to the management team and appropriate members of the organization.
5. Follow up the corrective action taken with periodic monitoring to assure the corrective action is implemented and is effective.

30. Handling, Storage and Delivery of Product and Materials

Material shall be stored, loaded, and shipped to avoid damage and deterioration. Material shall be marked with its identification and shall be listed on a manifest or shipping documents. Delivery instructions and any shipping agreements (e.g., sequencing that complies with erection needs) between the fabricator, the customer, the fabricator's subcontractors, or the fabricator's suppliers shall be included in written purchasing documents. Shipments by subcontractors and suppliers shall be coordinated and monitored for compliance with shipping and delivery instructions.

31. Internal Audit

The fabricator shall perform an internal audit of each element of the quality management system at least once a year to evaluate their compliance and the effectiveness of implementation. The management representative or a qualified individual, independent of the function being audited, shall perform the audit and provide a written record of the audit result from each element.

END OF SECTION 05 12 00

SECTION 05 12 13 - ARCHITECTURALLY EXPOSED 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 architecturally exposed structural steel (AESS).

1. Requirements in Section 051200 "Structural Steel Framing" also apply to AESS.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for additional requirements applicable to AESS.
2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other metal items not defined as structural steel.
3. Section 099000 “Painting and Coating” for surface preparation and priming requirements.

1.3 DEFINITIONS

A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents.

1.4 COORDINATION

A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation. Anchorage concepts shall be as indicated on drawings and approved on final shop drawings.

B. 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.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference to comply with requirements of Division 1 Section “Project Meetings.” As a minimum, the meeting shall include the General Contractor, Fabricator, Erector, the finish-painting subcontractor, and the Architect. Coordinate requirements for shipping, special handling, attachment of safety cables and temporary erection bracing, touch up painting and other requirements for AESS.

1.6 ACTION SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections. In addition to Division 1 requirements, provide one half-size hard copy (paper) of any drawings submitted in the electronic files.

B. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include details that clearly identify all of the requirements listed in the “Fabrication“ Article and the “Erection” Article of this specification. Provide connections for exposed AESS consistent with concepts shown on the architectural or structural drawings.
3. Include embedment Drawings.
4. 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. Indicate grinding, finish, and profile of welds.
5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
6. Indicate exposed surfaces and edges and surface preparation being used.
7. Indicate special tolerances and erection requirements.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification data for firms and persons specified in the ‘Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, and other information specified.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Division 5 Section ‘Structural Steel,’ engage a firm experienced in fabricating AESS similar to that indicated for this Project

with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.

B. Installer Qualifications: In addition to those qualifications listed in Division 5 Section ‘Structural Steel,’ engage an experienced Erector who has completed AESS work similar in material, design, and extent to that indicted for this Project and with a record of successful in-service performance.

C. Mockups: At least four weeks prior to fabricating AESS, the contractor shall construct mockups to demonstrate aesthetic effects as well as qualities of materials and execution. Mockups shall be built by the Contractor or Subcontractor responsible for the Project Work. Build mockups to comply with the following requirements, using all conditions and materials indicated for completed unit of Work.
   1. Locate mockups on-site or in the fabricator’s shop as directed by Architect. Mockups shall be full-size pieces unless the Architect approves smaller models.
   2. Notify the Architect 7 days in advance of the dates and times when mockups will be available for review.
   3. Demonstrate the proposed range of aesthetic effects regarding each element listed under the fabrication heading below.
   4. Mockup will have finished surface (including surface preparation and paint system).
   5. Obtain Architect’s approval of mockups before start of fabrication of final units.
   6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
   7. Coordinate painting requirements with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   8. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
   9. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. 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.

1.10 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 - PRODUCTS

2.1 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

B. Corrosion-Resisting (Weathering Steel), Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 3, round-head assemblies, consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

2.2 FILLER

A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.3 PRIMER

A. Primer: Comply with Section 099000 Painting and Coatings.

B. Etching Cleaner for Galvanized Metal: MPI#25.

C. Galvanizing Repair Paint: ASTM A 780/A 780M.

D. Shop Primer for Galvanized Steel: MPI#26, cementitious galvanized metal primer, MPI#80, vinyl wash primer, or MPI#134, water-based galvanized metal primer.

2.4 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
2. Grind sheared, punched, and flame-cut edges of **Category 1** AESS to remove burrs and provide smooth surfaces and edges.
3. Fabricate **Category 1** AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification. Mill marks shall be omitted by cutting of mill material to appropriate lengths where possible. Where not possible, the fabricator can fill and/or grind to a surface finish consistent with the approved mock up.
4. Fabricate **Category 1 and Category 2** AESS with exposed surfaces free of seams to maximum extent possible.
5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
7. Fabricate **Category 1** AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
8. Fabricate **Category 2 and Category 3** AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.
9. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for **Category 1** AESS.

C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.

1. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet under any lighting conditions.
2. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch.

D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for **Category 1** AESS.

E. Bolt Holes: Cut, drill, **mechanically thermal cut,** or punch standard bolt holes perpendicular to metal surfaces.

F. Cleaning Corrosion-Resisting Structural Steel: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. 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.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, unless otherwise indicated on the Contract Documents.

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, and comply with the following:

1. Appearance and quality of welds shall be consistent with the mock up.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
3. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
4. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where **Category 1** AESS is exposed to weather.
5. Provide continuous welds of uniform size and profile where **Category 1** AESS is welded.

6. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch for C**ategory 1 and Category 2** AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
7. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for **Category 1 and Category 2** AESS.
8. At locations where welding on the far side of an exposed connection of **Category 1 and Category 2** AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
9. Make fillet welds for **Category 1 and Category 2** AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.
10. Where fillet welds are indicated to be ground-contoured, or blended, oversize welds as required and grind to provide a smooth transition and to match profile on approved mock-up.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to AESS according to ASTM A 123/A 123M.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
3. Fabricate such that all connections of assemblies are made in the field with bolted connections. Provide galvanized finish or members and assemblies within the range of color and surface textures presented in the mock ups.

B. Minimize distortion and warpage of steel members being galvanized by following recommendations according to ASTM A 384/A 384 M.

1. Do not apply galvanizing using double- dip or progressive processes without Architect’s or Engineer’s written approval.

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 to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation **for Non-galvanized Steel**: 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 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

3. AESS receiving epoxy primers, rust-inhibitive primers, or polyurethane finish coats shall receive surface preparation according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
    a. Coordinate the required blast profile with the approved paint submittal prior to beginning surface preparation.

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. 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 2 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with 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 bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. 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 AESS 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. Handle, lift and align pieces using padded slings and/or other protection required to maintain the appearance of the AESS through the process of erection.

1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work or where approved by the Architect during the pre-installation meeting. Methods of removing temporary erection devices and finishing the AESS members shall be approved by the Architect prior to erection.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

1. Erect **Category 1** AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
2. Erect **Category 2 and Category 3** AESS to the tolerances specified in AISC 303 for steel that is not designated AESS.

B. Do not use thermal cutting during erection **unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M**.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened, unless otherwise indicated on the Contract Documents.
2. Orient bolt heads as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.

B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.

1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for **Category 1 and Category 2** AESS.
2. Remove erection bolts in **Category 1 and Category 2** AESS, fill holes, and grind smooth.
3. Fill weld access holes in **Category 1 and Category 2** AESS and grind smooth.
4. Obtain Architects approval for appearance of welds in repaired or field modified work.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place and determine acceptability based on the mockup. The Testing Agency shall have no responsibility for enforcing the requirements of this section.

3.6 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas 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.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

E. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 05 12 13

SECTION 05 21 00 - STEEL JOIST 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. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. LH-series long-span steel joists.
5. Joist accessories.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for field-welded shear connectors and galvanizing.
2. Section 05 31 00 "Steel Decking" for roof decking.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications".

B. Shop Drawings:
1. In addition to Division 1 requirements, provide one half-size hard copy (paper) of any drawings submitted in the electronic files.
2. Include layout, designation, number, type, location, and spacing of joists.
3. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
4. Indicate locations and details of bearing plates to be embedded in other construction.
5. A highly visible statement shall appear on the joist shop drawings indicating which joists are to receive special inspection by internal quality control personnel and which are to be inspected by the independent testing laboratory.

1.5 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: Prior to approval of the testing agency by the Architect/Engineer, a letter indicating the qualifications of the agency and all personnel to be utilized in the inspection of the joists, a statement about the proposed techniques for inspection, and a statement that they have read and understood these specifications, shall be submitted to the Architect/ Engineer.

B. Test Reports: Submit copies of reports of tests conducted on welded connections directly to the Architect/Engineer with copy to others in accordance with the provisions of Division 1 Section "Quality Control Services." Include data on type(s) of tests conducted and test results.

C. Welding certificates.

D. Manufacturer certificates.

E. Mill Certificates: For each type of bolt.

F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

G. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Source Limitations:
1. To the greatest extent possible steel shapes shall be manufactured with recycled material and shall be manufactured locally or within the State of Texas.

B. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications**."**

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

C. Distribution of Information: It shall be the responsibility of the general contractor and/or his steel fabrication sub-contractor to ensure that the steel joist fabricator receives a copy of the following prior to the commencement of shop drawings and fabrication.
1. Copies of the contract documents.
2. These specifications.
3. The names and addresses of the general contractor, the Architect's responsible office, and the Structural Engineer for distribution of necessary reports.

D. Acceptable Weld Quality: The quality of welds shall be visually inspected and a weld shall be accepted by visual inspection if the weld shows that:
1. The weld has no cracks.
2. Thorough fusion exists between adjacent layers of weld metal and between weld metal and the base metal at the welded connection.
3. All craters are filled to the full cross section of the weld joint.
4. All weld profiles shall be reasonably uniform. It is recognized that all web joint welds will not have a perfect profile; however, the effective throat and penetration shall be equal to the throat required by the design drawings. Visual inspection of the welds shall be made to confirm that unequal legs, excessive convexity, or overlap conditions do not detract from the effective throat of the weld.

5. Undercutting of welds is undesirable but is acceptable if the depth of undercutting does not exceed 1/32 inch. Welds that have undercutting in excess of 1/32 inch shall be repaired and re inspected.
6. Any cluster of surface porosity in the weld area is to be removed and replaced with sound weld metal.
7. The surface of the shop welds shall be reasonably clean prior to the inspection.

E. All welding procedures shall be covered by a written welding procedure specification, a copy of which shall be made available to the Architect/Engineer upon request.

F. Test Reports: The inspectors, in house or independent, shall issue written reports of the inspection results to the general contractor, structural steel supplier, and the Architect/Engineer. In the case of in house inspection, where multiple production lines and inspectors are involved, the reports may be issued by the quality control supervisor provided it can be proven by the joist manufacturer to the Architect/Engineer that this supervisor is personally involved in observing the work of the line inspectors on a regular and virtually continuous basis and is personally knowledgeable of the contents, intent, and desired results of this specification. These reports shall be issued for each shift for every day the job is in production.

G. The inspector shall observe the technique and performance of each welder and welding operator at such intervals as may be required to assure that the applicable welding requirements are met.

H. The above inspection procedures do not preclude the Architect/Engineer or Owner from employing a separate independent testing agency for the purpose of further inspection at the job site. In the event of conflict or disagreement, the decision of the Architect/Engineer or Owner will be final with regard to acceptance or rejection of the joists.

I. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications**."** Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

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. Vulcraft Group, Division of Nucor Corporation; 936-687-4665; www.vulcraft.com
2. New Millennium Building Systems, LLC; 870-722-4272; www.newmill.com
3. Canam-buildings, a business unit of Canam Group; 866-466-8769; www.canam-construction.com

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads, including wind uplift loads, as indicated on the Contract Documents.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:

a. Roof Joists: Vertical deflection of 1/360 of the span, or as indicated on the Contract Documents, whichever is more stringent.

2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists; however, deduct area of holes from the area of chord when calculating strength of member.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications," unless otherwise noted in Contract Documents.

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

H. Crimped Members: Crimped members shall be carefully inspected to detect any splits caused by the crimping process. Splits exceeding one half inch in length are not acceptable. In joists and joist girders used as part of a moment resistive frame, splits are not acceptable regardless of length. Nicks less than one eight inch in length caused by the shearing process are acceptable.

2.4 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows: (unless otherwise indicated on the Contract Documents.)

1. Joist Type: LH-series steel joists.
2. End Arrangement: Underslung.

3. Top-Chord Arrangement: Parallel, unless otherwise indicated on the Contract Documents.

B. Provide holes in chord members for connecting and securing other construction to joists; however, deduct area of holes from the area of chord when calculating strength of member.

C. Camber long-span steel joists according to SJI's "Specifications."

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.6 GALVANIZING

A. See Section 05 12 00 "Structural Steel Framing".

2.7 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging, including X-bridging, indicated on the plans where it would not normally be required, shall be provided to supplement continuity of the lateral bracing system to:
1. Support perimeter conventional framing, beams, posts for roof screens, and as indicated.
2. Offset bridging lines at roof openings, mechanical ductwork, and as indicated.

C. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

D. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

E. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.

F. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

1. Finish: Plain, uncoated.

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

1. Finish: Plain.

H. Welding Electrodes: Comply with AWS standards.

I. Galvanizing Repair Paint: ASTM A 780/A 780M].

J. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.8 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications**,"** joist manufacturer's written instructions, final shop drawings, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

C. Field weld joists to supporting steel bearing plates and framework, in accordance with the contract documents, or if not shown, with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Where joists penetrate fire walls, see Division 7 Section "Insulation" for related work.

E. Bolt joists to supporting steel framework using carbon-steel bolts.

F. Bolt joists to steel columns and at other locations where shown on the Contract Documents using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

G. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.
   1. Where "open web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.

H. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. At flat roofs (up to 1/4 inch per foot maximum slope), with joists of the same depth, splices shall be a minimum of 4 inches long with at least 1 1/2 inches of fillet weld on each side, and shall develop a minimum capacity of 700 pounds, whichever is greater. Splices may occur between joists unless a depth change occurs, or other conditions occur which would affect the continuity of the bridging. For either of these cases the splice must occur at the joist. If joists are not flat, splicing and weld requirements for bridging shall be designed by the joist manufacturer and noted in the shop drawings.

J. Sweep: Sweep of joists after installation shall not exceed the greater of one half inch or L/300. Bottom and top chords shall be maintained in a vertical plane.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, provide non-destructive testing as indicated by AISC 360 and the Contract Documents, whichever is more stringent. Test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:

      a. Liquid Penetrant Inspection: ASTM E 165/E 165M.
      b. Magnetic Particle Inspection: ASTM E 709.
      c. Ultrasonic Testing: ASTM E 164.
      d. Radiographic Testing: ASTM E 94.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

3.4 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Top Chord Repair: Repair all locations where the steel deck welding procedures have burned holes in the top chord members. Contact the Architect/Engineer for correction procedures.

C. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
2. Apply a compatible primer of same type as primer used on adjacent surfaces.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 21 00

SECTION 05 31 00 - 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. Composite floor deck.
2. Noncomposite vented form deck.

B. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 03 52 16 "Lightweight Insulating Concrete" for lightweight insulating concrete fill over steel deck.
3. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
4. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
5. Section 09 90 00 "Painting and Coatings" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections. In addition to Division 1 requirements, provide one half-size hard copy (paper) of any drawings submitted in the electronic files.

B. Product Data: For each type of deck, accessory, and product indicated.

C. 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."
1. Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

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 DECKING MATERIALS

A. Source Limitations:
1. To the greatest extent possible steel shapes shall be manufactured with recycled material and shall be manufactured locally or within the State of Texas.

2.2 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.

2.3 COMPOSITE FLOOR 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. Vulcraft Group, Division of Nucor Corporation; 936-687-4665; www.vulcraft.com
2. New Millennium Building Systems, LLC ; 870-722-4272; www.newmill.com
3. Epic Metals Corporation; 877-696-3742; www.epicmetals.com
4. Canam-buildings, a business unit of Canam Group; 866-466-8769; www.canam-construction.com
5. H.H. Robertson Floor Systems, a CENTRIA company; 800-932-0706; www.hhrobertson.com

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor 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 as Indicated on Contract Documents, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray baked-on, rust-inhibitive primer.
2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade as Indicated on Contract Documents, G90 zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade as Indicated on Contract Documents, G90 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
4. Profile Depth: As indicated on Contract Documents.
5. Design Uncoated-Steel Thickness: As Indicated.
6. Span Condition: Triple span or more.

2.4 NONCOMPOSITE VENTED 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. Vulcraft Group, Division of Nucor Corporation; 936-687-4665; www.vulcraft.com
2. New Millennium Building Systems, LLC ; 870-722-4272; www.newmill.com
3. Epic Metals Corporation; 877-696-3742; www.epicmetals.com
4. Canam-buildings, a business unit of Canam Group; 866-466-8769; www.canam-construction.com

B. Non-composite Vented Form Deck: Fabricate ribbed- and vented-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade as Indicated on Contract Documents G90 zinc coating.
2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade as Indicated on Contract Documents, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.

a. Color: Manufacturer's standard.

3. Profile Depth: As Indicated.
4. Design Uncoated-Steel Thickness: As Indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.
7. Vent Slot Area: Manufacturer's standard vent slots providing 1-1/2 percent open area.

2.5 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. Metal Cover Plates: Fabricate metal cover plates for end abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.

H. Metal Closure Strips: Fabricate metal closure strips, for openings between decking and other construction, of not less than 0.045 inch min. (18 gage) sheet steel. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 16 gage thickness, with factory-punched hole of 3/8-inch minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field. Galvanizing Repair Paint: ASTM A 780/A 780M.

L. 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. Locate deck bundles to prevent overloading of supporting members.

C. 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. Maximum vertical dimension between deck units at a support shall be 1/16 inch.

2. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

D. Place deck panels flat and square, secured to adjacent framing with top flange having no warping in excess of 1/16 inch across any three adjacent flanges.

E. Do not place deck units on concrete supporting structure until concrete has cured and is dry.

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. Coordinate reinforcing requirements of openings in first paragraph below with applicable Sections. Reinforce openings as indicated on the contract documents, and not less than:
1. Reinforce steel deck openings from 6 to 18 inches in size with 2x2x1/4 inch steel angles. Place angles perpendicular to flutes; extend a minimum of two flutes beyond each side of opening and fusion weld to deck at each flute.

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. Fastening Deck Units: The top flanges of the beams and the steel deck shall be free of paint, water, ice, oil, rust, or any other material which might interfere with the welding process.

J. 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. Install temporary shoring before placing deck panels if required to meet deflection limitations.

B. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading as indicated on the Contract Documents.

C. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: As Indicated on the Contract Documents.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds As indicated on Contract Documents.
3. Weld Washers: Install weld washers at each weld location where deck thickness is less than 0.028 inches.

D. 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:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, length as required, carbon-steel screws.
2. For decks with positive registering, interlocking male/female type side laps, join by button punching.

E. 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.

F. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12 inches apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

G. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. [Weld] to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

H. Sound Absorption Batts: Install sound absorbing batts immediately prior to installation of roof insulation. Keep materials dry before, during, and after installation.

I. Provide minimum 1 inch thick soft composition rubber closures above walls and partitions contiguous to acoustical steel roof deck.

3.4 FLOOR-DECK INSTALLATION

A. Floor decking units shall be temporarily shored in accordance with the manufacturer's Allowable Shoring Tables. Shoring requirements shall be determined as follows:

1. Bending stress shall not exceed 0.60 times the yield strength, nor exceed 36,000 psi under the combined weights of wet concrete, deck and the following construction live loads: 20 psf uniform load, or 150 lb. concentrated load on a 1' 0" width section of deck.
2. Slab dead load shall not cause deflection in excess of 1/180 of the span or a maximum of 3/4 inch. Shoring shall be designed in accordance with local building code provisions. Shoring shall be left in place until the concrete attains 75 percent design compressive strength.

B. Do not use floor deck units for storage or working platforms until permanently secured.

C. Fasten composite floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: As Indicated on the Contract Documents.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds at not more than 12 inches apart with a minimum of 2 welds per unit at each support.
3. Weld Washers: Install weld washers at each weld location where deck thickness is less than 0.028 inches**.**

D. Fasten non-composite floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: As Indicated on the Contract Documents.
2. Weld Spacing: As Indicated on the Contract Documents, at a minimum provide welds at the ends and at all end laps, provide welds at the side of each sheet (including sides where sheets lap), and at the midspan of each sheet. Provide welds at each support, and alternate the two following weld patterns: 1) at each side, and/or at each side lap, 2) at the midspan of each sheet, and at each side.
3. Weld Washers: Install weld washers at each weld location where deck thickness is less than 0.028 inches**.**

E. SDI requires side-lap and perimeter edge fastening if deck spans exceed 60 inches (1524 mm).

F. Side-Lap and Perimeter Edge Fastening: As Indicated on the Contract Documents, at a minimum, 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:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch long welds.

G. 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: 2” minimum lap for non-composite floor deck or Butted for composite floor decking.

H. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

I. 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.

J. Deformed bar anchors: Deformed bar anchors shall be automatically end welded on centers as shown on drawings in accordance with manufacturer's recommendations.

K. Shear Connectors: Shear connectors shall be solid fluxed and are to be automatically end welded through the metal deck at spacings shown on the drawings and in accordance with manufacturer's recommendations. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.

1. A minimum of 2 shear connector studs shall be welded at the start of each production period in order to determine proper generator, control unit, and stud welder settings. These studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet weld has not been obtained for a particular stud, such stud shall be struck with a hammer and bent approximately 15 degrees off perpendicular to the nearest end of the beam. Studs meeting this test shall be left in this position. Studs failing under this test shall be replaced. When the temperature is below 32 degrees F., one stud in each 100 shall be tested after cooling.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. 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.

END OF SECTION 05 31 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS.

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 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. Ceiling joist framing.
4. 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 061053 "Miscellaneous Rough Carpentry" for subflooring, wall sheathing, or roof sheathing using wood-based structural-use panels, particleboard, fibrous-felted board, and foam-plastic sheathing.
3. Section 092216 "Gypsum Board Assemblies" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 DEFINITIONS

A. Uncoated Steel Design Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the indicated thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming. Where decimal thicknesses of framing are not indicated, the thicknesses in “gages” and “mils” shall be provided in conformance with the thicknesses indicated in the Steel Stud Manufacturers Association.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

C. Engineer of Record: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing cold formed metal framing engineering services and is specifically hired to do so.

D. Engineering Services: Services performed by the Engineer of record for installations of cold-formed metal framing for this Project.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site prior to commencing the Work.
   1. Require attendance of parties directly affecting the Work of the section. The cold-formed metal framing Engineer of Record shall be an attendee of the Preinstallation Conference. If the Engineer of Record is not able to attend the scheduled Preinstallation Conference, the conference shall be rescheduled as many times as necessary, until the Engineer of Record is able to attend the conference.
   2. Review conditions of installation, installation drawings, procedures and coordination with related work.
   3. Approved Cold-Formed Metal Framing shop drawings shall be reviewed at the Preinstallation Conference with the Engineer of Record present for the review.
   4. Review required inspecting, testing, and certifying procedures.
   5. The Owner's Materials Testing Lab shall attend the Preinstallation Conference if the Owner has engaged the service of an independent lab for site inspections of CFMF.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

B. Shop Drawings:
   1. Provide shop/installation drawings prepared by cold-formed metal framing engineer.
   2. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   3. 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. For cold-formed metal framing, connection design including fasteners, clips, anchors and all other related aspects of the framing design: comply with all applicable model code required design loads. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. 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.

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.

F. Submittals required as part of component manufacturer's and installer's Quality Control Program(s) that include material control procedures, inspection procedures, and nonconformance procedures.

G. Component manufacturer's and installer's Quality Control Inspector qualifications.

H. Certificates of Compliance: Certificate from Professional Structural Engineer responsible for system design that system was designed in accordance with Contract Documents requirements, applicable Building Code, and generally accepted engineering practices.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
   1. The installer shall establish and maintain quality control procedures and perform inspections to ensure that the work is in accordance with AISI referenced documents and Contract Documents.

C. Engineer of Record:
   1. Engage a qualified professional Engineer to prepare design calculations, Shop Drawings, and other structural data as required.
   2. The Engineer of Record shall perform two (2) site inspections during installation and one (1) site inspection at completion of cold-formed metal framing.
   3. The Engineer of Record shall provide reports, including any nonconformance, issued to the Construction Manager, Owner, and Architect/Engineer within 48 hours of inspection.

D. 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.

E. 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."

F. AISI Specifications and Standards:
   1. Comply with AISI documents as referenced standards in the applicable version of the International Building Code for this project.
   2. Comply with AISI S202-15 "Code of Standard Practice for Cold-formed Steel Structural Framing".
   3. Comply with AISI S240-15 "North American Standard for Cold-Formed Steel Structural Framing", including Section D Quality Control and Quality Assurance.

1.8 DELIVERY, STORAGE AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling in accordance with AISI's "Code of Standard Practice".

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation in accordance with AISI's "Code of Standard Practice".

C. The contractor shall verify that the framing materials delivered meet the requirements of the contract, construction documents, and submittals.

PART 2 - PRODUCTS

2.1 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. The size of framing members indicated in the drawings, are minimum sizes – provide the indicated sizes, or larger sizes where structural engineering dictates larger sizes are required. Where larger sizes of studs, tighter spacing of studs or more studs are indicated by the Structural Engineer preparing the buildings framing design, provide these material increases to the job, at no additional cost of the Owner. In some instances, the stud sizes indicated may be larger than engineering analysis dictates are necessary - heavier indicated stud sizes may have been chosen, and subsequently indicated in order to support, or otherwise accommodate other building systems which require heavier stud gages than basic structural engineering (framing design to meet the Building Code) dictates – DO NOT DOWN-SIZE THE STUD SIZES 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. Exterior Load-Bearing Wall Framing used behind masonry veneer: Horizontal deflection of 1/600 of the wall height.
    b. Exterior Load-Bearing Wall Framing not used behind masonry veneer: Horizontal deflection of 1/360 of the wall height.
    c. Exterior Non-Load-Bearing Framing used behind masonry veneer: Horizontal deflection of 1/600 of the wall height.
    d. Exterior Non-Load-Bearing Framing not used behind masonry veneer: Horizontal deflection of 1/360 of the wall height.
    e. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
    f. Roof Rafter Framing: Vertical deflection of 1/360 of the horizontally projected span for live loads.
    g. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

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 1-1/2 inches.

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. Design framing installed behind exterior ceramic tile walls to comply with ANSI A108.11-4.0-4.3 requirements for framing.

E. 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.

2.2 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 (Z180) unless otherwise indicated, G90 (Z275) at masonry curtain-wall framing.

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 (Z180) unless otherwise indicated, G90 (Z275) at masonry curtain-wall framing.

2.3 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, minimum.

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 clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical

attachment to stud web to permit frictionless vertical movement, 68 mils (1.72 mm) minimum thickness, size as required by structural design calculations.
1. Basis-of-Design: VertiClip, The Steel Network, Inc. 888-474-4876 www.steelnetwork.com
2. Manufacturers: Subject to compliance with requirements, provide the named product, or a comparable product by other manufacturer.

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: 0.0538 inch.
2. Flange Width: As required to accommodate upward or downward deflection of primary structure.

E. 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.

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches, minimum.

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 head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web to permit frictionless vertical movement, 68 mils (1.72 mm) minimum thickness, size as required by structural design calculations.
1. Basis-of-Design: VertiClip, The Steel Network, Inc. 888-474-4876 www.steelnetwork.com
2. Manufacturers: Subject to compliance with requirements, provide the named product, or a comparable product by other manufacturer.

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: 0.0538 inch.
2. Flange Width: As required to accommodate upward or downward deflection of primary structure .

E. 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 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches, minimum.

B. Connector Devices: For transfer of loads from ceiling joist framing members to supporting structure, hanger type and size as required by structural design calculations. ASTM A 653/A 653M, structural steel, zinc coated.
1. Grade: As required by structural performance.
2. Coating: G90 (Z275).
3. Basis-of-Design: StiffClip, The Steel Network, Inc. 888-474-4876 www.steelnetwork.com
4. Manufacturers: Subject to compliance with requirements, provide the named product, or a comparable product by other manufacturer.]

2.6 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: 0.0428 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.7 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, with a minimum yield strength of 33,000 psi. Where any of the framing’s minimum yield strength is greater than 33,000 psi, i.e. 50,000 psi, accessory minimum yield strength shall be match the framings minimum yield strength.

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.

2.8 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 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 AC58 at masonry walls or ICC-ES AC308 at concrete walls as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Adhesive anchor.
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 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

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.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780/A 780M, MIL-P-21035B, or SSPC-Paint 20.

B. 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.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

D. 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.

2.10 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, Engineer’s shop/installation drawings, 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. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

D. 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.

E. 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, Engineer's shop/installation drawings, 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. Provide supplementary framing, blocking, and bracing where metal framing systems are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, metal roof, wall, and soffit panels, and similar work requiring attachment. Where type of supplementary support is not otherwise indicated, comply with cold- formed metal framing manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

E. 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.

F. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

G. 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.

H. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

I. 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.

J. 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 bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Shop Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb 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. Connect vertical deflection clips to bypassing studs and anchor to building structure.
3. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. At exterior walls where walls are adjacent to the primary building structure, connect vertical deflection clips with slip capability, to the studs and anchor the clips to the primary building structure. The connection at the stud is to allow vertical movement only, not horizontal movement. Tighten connection nuts for vertical movement only. Deflection clips shall have vertical slot connection holes for vertical movement. Locate the slots adjacent to the stud, not at the primary building structure. The slip fasteners at the studs shall allow vertical movement without the fastener being able to disconnect from and fall from the framing studs. Slip connection shall be with bolts, nuts and washers unless the framing manufacturer has other recommendations that are acceptable to the Architect – submit designs in shop drawings. If framing manufacturer does not have other permanent fastening options that are acceptable to the Architect, deform the bolt threads after the nuts are in place to create a permanent fastener installation.

F. 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. Subject to compliance with authorities having jurisdiction and other requirements, provide either bridging method indicated immediately above.
4. Where Portland Cement Plaster (PCP) is to be installed over walls, and the lath used in the PCP is welded wire lath, the wall bracing shall be provided in accordance with the International Building Code section 2308.9.3 or section 2308.12 regardless of type of studs used in the PCP wall.

G. 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 every other stud and at additional locations as indicated on shop drawings.

H. 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 tobottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

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. Connect vertical deflection clips to studs and anchor to building structure.
3. 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. Subject to compliance with authorities having jurisdiction and other requirements, provide either bridging method indicated immediately above.
4. Where Portland Cement Plaster (PCP) is to be installed over walls, and the lath used in the PCP is welded wire lath, the wall bracing shall be provided in accordance with the International Building Code section 2308.9.3 or section 2308.12 regardless of type of studs used in the PCP wall.

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 every other stud and at additional locations as 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 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated on Drawings.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to bottom flange of joists.

2. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
3. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
4. Subject to compliance with authorities having jurisdiction and other requirements, provide any bridging method indicated above.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 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.

3.8 FIELD QUALITY CONTROL

A. Inspection: Component manufacturer and installer shall inspect the work as required by their Quality Control Program(s) per AISI S240-15.

B. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

C. Field and shop welds will be subject to testing and inspecting.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 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 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items.
   1. Loose lintels.
   2. Bollards.
   3. Steel ladders.
   4. Steel ships ladders.
   5. Structural supports for miscellaneous attachments.
   6. Steel framing and supports for mechanical and electrical equipment.
   7. Other miscellaneous steel items indicated or as required for complete installation of indicated work.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
   2. Section 05 12 00 - Structural Steel.
   3. Section 05 21 00 - Steel Joists and Joist Girders.
   4. Section 05 31 13 – Steel Floor Decking.
   5. Section 05 31 23 - Steel Roof Decking.
   6. Section 09 90 00 - Painting and Coating: Field applied paint finish.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   6. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   7. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   8. ASTM F436 - Standard Specification for Hardened Steel Washers.

B. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

C. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 15 - Steel Joist Shop Paint.
   2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification

within previous 12 months.

1.4 QUALIFICATIONS

A. Fabricator Qualifications: A firm experienced in producing metal fabrications 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

1.6 FIELD MEASUREMENTS

A. Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Plate: ASTM A36/A36M.

C. Hollow Structural Sections: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40. .

E. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality with galvanized coating.

F. Bolts: ASTM A307; Grade A or B.

G. Nuts: ASTM A563 heavy hex type.

H. Washers: ASTM F436; Type 1.

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Shop Primer: SSPC Paint 15, or manufacturer’s standard primer complying with performance requirements of SSPC Paint 15.

K. Touch-Up Primer: Match shop primer.

L. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20.

2.2 LOOSE LINTELS

A. Lintels: Steel sections, size and configuration as indicated on Drawings, length to allow 8 inches minimum bearing on both sides of opening.

B. Galvanize loose lintels installed in exterior walls.

2.3 ANGLE EXTENSIONS FOR WIRE MASONRY ANCHORS

A. Fabricate angle extension for wire masonry anchors from steel angles, 2" x 2" x 1/8". Provide a 1/4" x 1" slot in the vertical leg of the angle, 1" back from the end for receiving the 3/16" wire masonry anchors specified in Division 4 Section "Unit Masonry". Fabricate in lengths such that the overall length of the angle extension is equal to the distance from the web of column or beam to 1" from the back of the masonry wall. Reference detail in drawings for additional clarification.

B. Weld the angle extension, with a continuous fillet weld, at 16" o.c. horizontally at beam webs and vertically at column webs where support of masonry walls is indicated.

2.4 BOLLARDS

A. Fabricate bollards from Schedule 80 steel pipe, size as indicated.

B. Standard Bollards: Fill with 3,000 psi concrete as specified in Section 03 30 00, with crowned cap.

C. Removable Bollards: Fabricate sleeves from Schedule 40 steel pipe or 1/4 inch wall thickness steel tubing with an ID 1/4 inch less than OD of bollards. Match drill sleeve and bollard for 1/2 inch steel machine bolt.
1. Cap removable bollards with 1/4 inch minimum steel plate. Do not fill with concrete.

2.5 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
1. Comply with ANSI A14.3, unless otherwise indicated.
2. Provide hot-dip galvanizing after fabrication for exterior ladders.
3. For elevator pit ladders, comply with ASME A17.1.

B. Side Rails: Continuous 1/2 x 2-1/2 inch flat bars with eased edges, spaced 18 inches apart.

C. Bar Rungs: 3/4 inch round steel bars, spaced 12 inches o.c.
1. Fit bar rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
2. Provide nonslip surfaces on top of each bar rung by coating with abrasive material metallically bonded to rung by a proprietary process.
a. Manufacturers:
1) Mebac; IKG Borden www.ikgindustries.com
2) SLIP-NOT; W. S. Molnar Company www.wsmolnar.com

D. Tread Rungs: Inverted channel shape; 2-1/2” W. x 1-1” D. X 14 ga. steel with serrated and punched top surface.
1. Manufacturers:
a. Grip Strut, McNichols Manufacturing Co. www.mcnichols.com

E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

2.6 STEEL SHIP'S LADDERS

A. Ship’s Ladders: Fabricate with structural steel channel stringers, steel pipe handrails, and minimum 3/16” steel bar grating treads on nominal 3/4” centers with open risers, unless otherwise indicated. Provide brackets and fittings for installation.

B. Dimensions - Unless otherwise indicated:
1. Width: 24 inches.

2. Stringer depth: Minimum 10 inches.
3. Inclination: 60 degrees from horizontal.
4. Tread Depth: Minimum 7 inches.
5. Riser Height: Maximum 12 inches and minimum 9 inches.

C. Railings: As specified in Section 05 52 00 - Metal Railings.

D. Galvanize ship's ladders, including brackets and fasteners, in exterior locations, and elsewhere where indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural steel framework as necessary to complete the Work.

B. Fabricate units from structural 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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches wide by 1/4 inch thick by 8 inches long at 24 inches o.c., unless otherwise indicated.
2. Furnish inserts if units must be installed after concrete is placed.

C. Operable Partitions: Fabricate supports for operable partitions of continuous steel shapes of sizes indicated, with attached bearing plates, anchors, and braces. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition shop drawings.

2.8 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.9 FACTORY APPLIED FINISHES - STEEL

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Galvanizing: Hot-dip galvanize all items exposed to the exterior, ASTM A123/A123M, minimum 2.0 oz/sq ft coating thickness.
1. Galvanize after fabrication.
2. After galvanizing, fill vent holes and grind smooth
3. Do not apply galvanizing using double- dip or progressive processes without Architect’s or Engineer’s written approval.
4. Galvanizing for Fasteners, Connectors, and Anchors:
   a. Hot-Dipped Galvanizing: ASTM A153/A153M.
   b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

C. Prime paint items with one coat except where galvanizing is specified.

1. Do not prime surfaces in direct contact with concrete or where field welding is required.

2.10 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on shop drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval of Architect/Engineer prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story or for every 12 ft in height whichever is greater, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 51 00 - METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Steel stair frame of structural sections, with closed risers and pan to receive concrete fill.
2. Metal nosings.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete: Concrete fill in stair pans and landings.
2. Section 05 50 00 - Metal Fabrications: Steel ship's ladders.
3. Section 05 52 00 - Metal Railings: Railings attached to metal stairs.
4. Section 09 90 00 - Painting and Coating: Paint finish.

1.2 REFERENCES

A. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
4. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
5. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
6. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
7. ASTM F436 - Standard Specification for Hardened Steel Washers.

B. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

C. National Association of Architectural Metal Manufacturers:
1. NAAMM AMP 510 - Metal Stairs Manual.

D. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.
2. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

1.3 DESIGN REQUIREMENTS

A. Fabricate stair assembly to support uniform live load of 100 lb/sq ft and concentrated load of 300 lb/sq ft with deflection of treads, stringers, or landings not to exceed 1/360 of span or 1/4 inch, whichever is less.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings:
1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
2. Shop Drawings: Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
3. Indicate exact profile of proposed nosing. Include block-out or shimming requirements for flush installation with any finish tread materials.

C. Design Data: Submit design calculations.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 QUALIFICATIONS

A. Prepare Shop Drawings under direct supervision of Professional Engineer experienced in design of this Work and in the State of Texas.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Steel Sections: ASTM A36/A36M.

B. Steel Plate: ASTM A36/A36M.

C. Hollow Structural Sections: ASTM A500, Grade B.

D. Steel Pipe: ASTM A53/A53M, Grade B Schedule 40. .

E. Sheet Steel: ASTM A1008/A1008M, uncoated cold rolled steel sheet.

F. Welded Wire Fabric: ASTM A185, 6 x 6 W1.4 x W1.4.

G. Bolts: ASTM A307; Grade A or B.

H. Nuts: ASTM A563 heavy hex type.

I. Washers: ASTM F436; Type 1.

J. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.

K. Welding Materials: AWS D1.1; type required for materials being welded.

L. Concrete: Type specified in Section 03 30 00.

M. Shop Primer: SSPC Paint 15, Type 1, red oxide.

N. Touch-Up Primer: Match shop primer.

O. Abrasive Nosings: Single-stage surface-mount type meeting requirements of ASTM B221.
1. Black aluminum oxide abrasive strips set in 3” wide x 1/4” x continuous mill finish extruded aluminum plate with integral turn-down nosing. Provide (5) abrasive strips with a total combined width of not less than 1-inch.
2. Basis-of-Design: No. A3D as manufactured by Babcock-Davis or approved equivalent by Balco.
3. Predrill for flat-head flush expansion anchors set no more than 3” from each end and maximum 15” O.C.; designed for post-installation on concrete-filled metal pan stair treads just prior to installation of finish tread materials.
4. Each nosing shall be in one piece section and shall run from stringer to stringer.

2.2 FABRICATION

A. Comply with NAAMM AMP 510, "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" for Commercial Class, unless more stringent requirements are indicated.

B. Preassemble stairs in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Fabricate components with joints tightly fitted and secured.

D. Continuously seal joined pieces by continuous welds.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

I. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain at slope not to exceed 1/4 inch per foot.

2.3 FABRICATION - PAN STAIRS AND LANDINGS

A. Fabricate stairs and landings with closed risers and treads of metal pan construction, ready to receive concrete.

B. Form treads and risers with minimum 14 gage sheet steel stock.

C. Secure tread pans to stringers with clip angles welded in place.

D. Form stringers with rolled steel channels or rectangular hollow sections, minimum 12 inches deep. Close exposed ends of channels and tubes with minimum 14 gage steel sheet.

E. Form landings with minimum 14 gage sheet stock. Reinforce underside with angles to attain design load requirements.

2.4 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Shop prime metal stairs. Do not prime surfaces that will be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete and or embedded in masonry with setting templates.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Install anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.

D. Field weld components indicated on shop drawings. Perform field welding in accordance with AWS D1.1.

E. Field bolt and weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.

G. Obtain approval of Architect/Engineer prior to site cutting or creating adjustments not scheduled.

H. Metal Nosings:

1. Install specified metal nosing in wet concrete infill. Keep traffic off of stairs until completed installation of nosing and curing of concrete, minimum 48 hours.

2. When treads are scheduled for tile, rubber, or other finish product with thickness, coordinate with finish material installer to ensure flush condition at interface of finish material and nosing plate.

I. After erection, prime welds, and abrasions, except surfaces to be in contact with concrete.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

END OF SECTION

SECTION 05 52 00 - METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Shop-primed steel railings.
2. Stainless steel railings.
3. Aluminum railings.
4. Perforated aluminum infill panels at railings.

B. Related Sections:
1. Section 01 23 00 – Alternates: Reference alternate for brushed stainless steel handrails in lieu of the specified anodized aluminum.
2. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of anchors specified in this section in concrete.
3. Section 04 20 00 - Unit Masonry Assemblies: Execution requirements for placement of anchors specified in this section in masonry.
4. Section 05 51 00 - Metal Stairs.
5. Section 09 21 16- Gypsum Board Assemblies: Execution requirements for placement of anchors specified in this section in stud wall construction.
6. Section 09 90 00 - Painting and Coating: Paint finish.

1.2 REFERENCES

A. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
3. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

B. SSPC: The Society for Protective Coatings:
1. SSPC Paint 15 - Steel Joist Shop Paint.

1.3 DESIGN REQUIREMENTS

A. Design handrail, guardrail, and attachments to resist forces as required by applicable code. Apply loads non-simultaneously to produce maximum stresses.
1. Guard Top Rail and Handrail Concentrated Load: 200 pounds applied at any point in any direction.
2. Guard Top Rail Uniform Load: 50 plf applied in any direction.
3. Intermediate Rails, Panels, and Baluster Concentrated Load: 50 pounds applied to 1 sf area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples:

1. Submit one 6” x 6” sample of perforated clear anodized aluminum infill panel.

2. Provide on-site mock-up of decorative steel railing section with finish painted steel and clear anodized perforated infill panel. Mock-up shall be full size and include at least 2

vertical supports and one infill panel. Mock-up may be utilized in the permanent construction if approved.

D. Product Data: Submit manufacturer's data for wall brackets.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 STEEL RAILING SYSTEM COMPONENTS

A. Tubing: ASTM A513, Type 5, minimum 50 ksi yield strength.

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

C. Hollow Structural Sections: ASTM A500, Grade B.

D. Pipe: ASTM A53/A53M, Grade B, Schedule 40.

E. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast steel.

F. Splice Connectors: Steel welding collars.

G. Shop Primer: SSPC Paint 15, Type 1, red oxide.

H. Touch-Up Primer: Match shop primer.

2.2 MISCELLANEOUS COMPONENTS

A. Perforated Infill Panels: Perforated aluminum sheet as follows:
1. Hole Pattern: 1/2-inch diameter holes on 5/8 inch staggered centers.
2. Thickness: 1/8-inch.
3. Manufacturer: McNichols Co., www.mcnichols.com or approved equivalent by Accurate Perforating, accurateperforating.com.
4. Finish: Clear anodized.

B. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

C. Cast-in-Place and Post-installed Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete.
1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.

D. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Brackets, Flanges, and Anchors: Cast or formed metal of same material and finish as supported rails, unless otherwise indicated.
1. Manufacturers:
a. Malleable Iron or Cast Steel: Series 378/ 1378; Julius Blum and Co. www.juliusblum.com

2.3 ALUMINUM RAILING SYSTEM COMPONENTS

A. Pipe: Extruded aluminum, Schedule 40.

B. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast aluminum.

C. Splice Connectors: Welding collars; cast aluminum.

D. Interior Aluminum Surfaces: AAMA A41 anodized, prepared with mechanical pre-treatment, clear anodized.

E. Removable sections of Aluminum guardrails. Locations as indicated in drawings.

2.4 FABRICATION

A. Preassemble handrails and railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members as follows:
1. By flush radius bends.
2. By inserting prefabricated flush-elbow fittings.

C. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.

E. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

F. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

G. For railing posts set in concrete, provide preset sleeves of steel not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, and steel plate forming bottom closure.

H. For removable railing posts, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

I. Close exposed ends of handrail and railing members with prefabricated end fittings.

J. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.

K. Interior Components: Continuously seal joined pieces by continuous welds.

L. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

M. Accurately form components to fit stairs and landings, each other, and building structure.

N. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

2.5 FINISHES

A. Shop prime steel railings and hardware. Do not prime surfaces that will be embedded in concrete or masonry.

B. Anodize aluminum railings and hardware after fabrication. Provide anodized aluminum fittings, brackets, fasteners, sleeves, and other components.

C. Shop paint perforated steel panels with polyurethane enamel paint, electrostatically-applied, color as selected by Architect from manufacturer's full range of options.

2.6 COMPONENTS FOR STAINLESS STEEL ALTERNATE

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304, Schedule 40.

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Sheet, Strip, Plate, and Flat Bar: ASTM A 666, Type 304.

E. Bars and Shapes: ASTM A 276, Type 304.

F. Fittings: Elbows, T-shapes, wall brackets, escutcheons; stainless steel.

G. Splice Connectors: Stainless steel welding collars.

H. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

I. Finish:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Brushed Finish: Grind and polish surfaces to produce uniform finish with slight brush in direction of grain, free of cross scratches. Run grain of directional finishes with long dimension of each piece.
3. Directional Satin Finish: No. 4.
4. When finishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete, embedded in masonry, or placed in partitions with setting templates.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Set embedded posts in pipe sleeves and fill space between post and sleeve with nonshrink grout.

C. Fit exposed connections together to form tight, hairline joints.

D. Anchor railings to structure.

E. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

G. Assemble tube rails with sleeves to accommodate tight joints and secure installation.

H. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
   1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
   2. Secure wall brackets to building construction as follows:
      a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
      b. For hollow masonry anchorage, use toggle bolts.
      c. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Offset From Alignment: 1/4 inch.

D. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Roof curbs, cants, and perimeter nailers.
2. Blocking in wall and roof openings.
3. Plywood sheathing.
4. Wood furring and grounds.
5. Concealed wood blocking for support of toilet accessories, wall cabinets, handrails, and other wall-mounted items.
6. Telephone and electrical panel back boards.
7. Fire retardant and preservative treatment of wood.

1.2 REFERENCES

A. American Forest and Paper Association:
1. AF&PA - National Design Specifications for Wood Construction.

B. American Wood-Preservers' Association:
1. AWPA U1 - User Specification for Treated Wood.

C. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Southern Pine Inspection Bureau:
1. SPIB - Standard Grading Rules for Southern Pine Lumber.

E. U.S. Department of Commerce National Institute of Standards and Technology:
1. DOC PS 1 - Construction and Industrial Plywood.
2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20 - American Softwood Lumber Standard.

F. West Coast Lumber Inspection Bureau:
1. WCLIB - Standard Grading Rules for West Coast Lumber.

G. Western Wood Products Association:
1. WWPA G-5 - Western Lumber Grading Rules.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit technical data on wood preservative and fire retardant treatment materials and application instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
1. Lumber Grading Agency: Certified by DOC PS 20.
2. Plywood Grading Agency: Certified by EWA - The Engineered Wood Association.
3. Lumber: DOC PS 20.
4. Plywood: DOC PS 1 or DOC PS 2.

B. Surface Burning Characteristics:
1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire retardant treated material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: AF&PA, SPIB, WCLIB, WWPA G-5.

B. Miscellaneous Framing: Southern pine, mixed southern pine or spruce-pine-fir species; 19 percent maximum moisture content.

C. Plywood: APA/EWA; southern pine or douglas fir species; 1/2 inch thick, minimum.

2.2 ACCESSORIES

A. Fasteners and Anchors:
   1. Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished or cadmium plated steel elsewhere.
   2. Nails and Staples: ASTM F1667.
   3. Anchors:
      a. Toggle bolt type for anchorage to hollow masonry.
      b. Expansion shield and lag bolt type for anchorage to solid masonry or concrete.
      c. Bolt or ballistic fastener for anchorages to steel.

2.3 FACTORY WOOD TREATMENT

A. Preservative Treatment: AWPA U1, Use Category UC2; using inorganic boron (SBX) preservative with 0.25 percent retainage.

B. Fire Retardant Treatment: AWPA U1, Use Category UCFA for interior use, and UCFB for exterior use; chemically treated and pressure impregnated.

C. Moisture Content after Treatment:
   1. Lumber: Maximum 19 percent.
   2. Plywood: Maximum 15 percent.

2.4 FIELD WOOD TREATMENT

A. Preservative Treatment: Brush applied inorganic boron solution, with minimum concentration of 1.5 percent.

B. Touch-up cut wood ends.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.2 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

3.3 INSTALLATION

A. Set members level and plumb, in correct position.

B. Place horizontal members, crown side up.

C. Construct curb members of solid wood sections.

D. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

E. Coordinate curb installation with installation of decking and support of deck openings.

F. Secure sheathing to framing members with ends over firm bearing and staggered.

G. Install plywood parapet sheathing using 1/2 inch thick plywood. Space panels 1/8 inch apart at edges and ends.

H. Install telephone and electrical panel back boards using 3/4 inch thick plywood. Size back boards 12 inches beyond size of electrical and telephone panel, or as indicated on Drawings.

3.4 SCHEDULE OF WOOD TREATMENT

A. Note: The term “Treated” as may be used on the drawings for wood products does not distinguish between Fire-Retardant Treated or Preservative Treated. Conditions as specified below shall take precedence over drawing notations. Where governing code authorities require Fire-Retardant Treatment in addition to conditions stated below or noted in the drawings, those authorities shall govern.

B. Fire-Retardant Treatment: In buildings of Types I-B, II-A, and II-B construction, all rough carpentry items shall be fire retardant treated in the following conditions:
   1. All wood including but not necessarily limited to cants, nailers, shims, curbs, equipment support bases, blocking, and sheathing built into the roof or above the roof line. Use only preservative treatment formulated for exterior use.
   2. Blocking, nailers, supports, shims or other wood construction within the building whether or not concealed within walls or above-celling shall be fire-retardant treated. For wood in contact with concrete slab-on-grade use only preservative treatment formulated for exterior use
   3. Any wood Items indicated on the drawings as “Fire-Retardant Treated”.

C. Preservative Treatment: Install preservative treated wood in the following conditions:
   1. All wood including but not necessarily limited to sills, sleepers, blocking, furring, stripping, and wood flooring nailers that are in contact with concrete slab-on-grade or built into exterior walls.
   2. All wood framing, blocking, and furring members used in exterior construction except for Fire-Retardant Treated wood conditions as specified above.
   3. All wood framing, blocking, furring, and roofing wood including cants, nailers, shims, curbs, equipment support bases, and sheathing used in concession buildings, toilet buildings, press box buildings, and similar free-standing separate ancillary buildings shall be Preservative Treated.

END OF SECTION

SECTION 06 20 24 – INTERIOR FINISH CARPENTRY AND MILLWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Miscellaneous wood or plastic laminate clad millwork items that are not included in Section 12 32 16 Plastic Laminate Clad Casework.
   2. Chair rails at offices where noted, with matching PVC edge banding.
   3. Finished hardwood cap at low walls.
   4. Subflooring construction for Oak treads and risers at stage.

B. Related Sections include the following:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood furring, blocking, shims, and hanging strips required for installing finish carpentry and millwork items.
   2. Section 09 64 13 – Finish Wood Stage Steps: Finish wood flooring at stage treads and risers.
   3. Section 09 90 00 - Painting and Coating: Transparent finish of field-finished millwork items.
   4. Section 12 32 16 Plastic Laminate-Clad Casework.

1.2 REFERENCES

A. American Forest and Paper Association:
   1. AF&PA - National Design Specifications for Wood Construction.

B. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of required furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Indicate wood type and finish of each piece of construction.

D. Samples:
   1. Submit three representative samples of each finish carpentry and millwork item, illustrating wood grain, edge and corner condition(s), and finish.

1.4 QUALITY ASSURANCE

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for interior finish carpentry including wood grades, construction, finishes, and other requirements.

B. Surface Burning Characteristics for Fire Retardant Treated Items: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
   1. Where required by authority having jurisdiction, apply label from approved agency identifying each item.

1.5 QUALIFICATIONS

A. Installer Qualifications: An experienced installer who has completed finish interior carpentry similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in producing finish interior carpentry millwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect work from moisture damage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Comply with AWI requirements.

C. Maintain temperature and humidity conditions within ranges recommended by AWI. Do not deliver or install millwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

D. Allow materials to acclimate to temperature and humidity conditions recommended by AWI for minimum of 48 hours prior to installation. Maintain same conditions during and after installation.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work with electrical rough-in and installation of associated and adjacent finishes.

C. Coordinate locations and requirements for blocking and backing for support and attachment of work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Laminate Surfacing: Comply with NEMA Standard GP50 high pressure laminated plastic as provided by Wilsonart, Formica, or Pionite. Provide 0.050 inch thick material at horizontal surfaces, and 0.030 inch thick laminate on exposed vertical surfaces. Provide backing sheet on bottom or concealed surfaces. Color(s) to be selected by the Architect from manufacturer’s full range.

B. Hardwood Lumber for Low Wall Caps: Graded in accordance with AWI QSI Grade II; maximum moisture content of 8 percent, and the following:
1. Species of Wood: Red Oak.
2. Grade: Clear.
3. Cut: Plain sawn.
4. Moisture Content: 12 to 14 percent.
5. Thickness: As indicated.
6. Width: As indicated.

7. Finish: Transparent, clear finish or with stain color indicated.

C. Hardwood Plywood and Face Veneers: HPVA HP-1, Grade A, min 7-ply wood veneer core, face species to match hardwood lumber.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.

D. Concealed Plywood: U.S. Product Standard PSI-66, 7-ply wood veneer core Douglas Fir plywood, grade trademarked DFPA, sanded. A-D grade. Use only in concealed areas or as core for plastic laminate. Use exterior grade at sink cabinets.

2.2 ACCESSORIES

A. Fasteners and Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors in masonry walls.

B. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive.

C. PVC Edge Trim: Extruded rigid PVC; smooth finish, of width to match component thickness; standard or custom color as required to match plastic laminate; 1 mm and 3 mm thickness.

D. Glass: Clear tempered double strength, as specified in Section 08 80 00.

E. Fasteners and Anchors:
1. Fasteners: Hot dipped or Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.

F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

G. Concealed Joint Fasteners: Threaded steel.

H. Grommets:

1. Type: Plastic or nylon 2-1/2” diameter with flip-top tab in cap, in color(s) as selected by the Architect.

2. Locations: Where indicated on the drawings and where needed for data wiring to pass through counter tops, whether or not indicated.

3. Basis of Design: Model #EDP3 as manufactured by Doug Mocket & Co., 800-523-1269.

2.3 FABRICATION, GENERAL

A. Provide Custom grade interior millwork complying with the referenced quality standard. All work shall be of the highest quality workmanship thoroughly sanded and cleaned, free from tool marks, with all nails properly set, filled and sanded smooth. Moldings and trim shall be furnished in as long lengths as practicable. All pencil and chalk marks shall be removed.

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 millwork to dimensions, profiles, and details indicated.

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.

2.4 INTERIOR STANDING AND RUNNING TRIM

A. Quality Standard: Comply with AWI Section 300.

B. Wood Species: Hardwood lumber as identified on the drawings.

C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

D. Finish: Transparent, with stain color indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition millwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural millwork, examine shop-fabricated work for completion and complete work as required, including removal of packaging and.

3.2 MISCELLANEOUS MILLWORK INSTALLATION

A. Install miscellaneous millwork 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.

B. Scribe and cut millwork to fit adjoining work and refinish cut surfaces and repair damaged finish at cuts.

C. Anchor millwork to anchors or blocking built in or directly attached to substrates. Secure with concealed fasteners and blind nailing as required for complete installation.

D. Field Finishing:
1. Mask off adjacent surfaces before beginning sanding.
2. Apply filler and sand final construction to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum and tack rag.
3. Apply single coat of sanding sealer to protect construction until final finishing.
4. Apply stain where required to match final color of approved sample Determine from the Architect whether stain and finish or only clear finish is required.
5. Apply 3-coats of specified clear finish over sanding sealer or stain as determined by the Architect. Allow each coat to fully dry and sand lightly between coats. Clean dust with vacuum and tack rag.

3.3 SUBFLOORING FOR WOOD STAGE STEPS

A. Coordinate with wood flooring installer to determine specific project needs for subflooring construction at stage steps.

B. Reference the Drawings and Section 09 64 13 for general requirements for subflooring under finish Oak treads and risers.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective millwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace millwork. Adjust joinery for uniform appearance.

B. Clean millwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 06 42 19 - PLASTIC LAMINATE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Plastic laminate-clad individual panels with all edges finished.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Concealed sheet metal mounting bands required for installing paneling. Wood blocking as may be required by the panel manufacturer or installer.
   2. Section 09 21 16 – Gypsum Board Assemblies: Installation and finishing of drywall after installation of sheet metal mounting bands.
   3. Section 09 90 00 – Painting and Coating: Finish painting of drywall prior to installation of panels.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each product indicated.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations based on job measurements.
   1. Show typical and all non-typical details full size.
   2. Show locations and sizes of concealed mounting clips.
   3. Show typical location for exposed false mounting bolts and washers.

D. Samples for Verification: For the following:
   1. Plastic laminate chain of samples for initial approval of color/finish selection.
   2. Plastic-laminate-clad panel sections nominal 8 by 10 inches face size, with matching vinyl edges. Provide one sample panel for each selected color/pattern/finish once initial selections are determined.

E. Provide fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or other testing and inspecting agency acceptable to authorities having jurisdiction

F. Product Certificates: Signed by manufacturers of paneling certifying that products furnished comply with requirements.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed paneling similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

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

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of paneling, construction, finishes, and other requirements.

1.4 MOCK-UP

A. Section 01-40 00 - Quality Requirements: Mock-up requirements.

B. Before fabricating panels build onsite mockup using a minimum of (3) stacked panels mounted on finished stud wall. Approved mockup will become the standard of fit, finish,

materials and workmanship for the completed Work. Build mockup to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockup in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be installed.
3. Use only materials that meet the requirements of the specifications, and finish materials in the selected color(s) and finish(es).
4. Obtain Architect's approval of mockup before starting paneling fabrication.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approved mockups may become part of the completed Work.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling 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 paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where paneling 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 paneling 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 paneling 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 paneling can be installed as indicated.

PART 2 - PRODUCTS

2.1 PANELING FABRICATORS

A. Available Fabricators: Subject to compliance with requirements, fabricators offering paneling that may be incorporated into the Work include, but are not limited to, the following:

1. Panel Specialists, Inc. (PSI), www.panelspec.com.
2. Custom Plastics, www.customplastics.com.
3. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
1. Particle board: 4-pound density particle board core faced with fire-rated vertical surface type (.030") high-pressure laminate and backed with .028" high pressure laminate backer sheet.
2. Manufacturer: Provide "Duraflake FR" by Willamette Industries or equivalent.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
1. Available Manufacturers:
a. Formica Corporation.
b. International Paper; Decorative Products Div, www.internationalpaper.com.
c. Pionite Decorative Surfaces, www.pionite.com.
d. Laminart, www.laminart.com.
e. Wilsonart International, www.wilsonart.com.

D. Panel Fire-Test-Response Characteristics: Fabricated panels rated **Class A** in accordance with ASTM-E-84;
1. Flame spread **25 or less.**
2. Smoke developed **460 or less.**
3. Cataloged by Underwriters Laboratories as UL 723.
4. Provide fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or other testing and inspecting agency acceptable to authorities having jurisdiction.
5. Rated Class “A”.
6. Flame Spread Rating: Less than 25.
7. Smoke Developed Rating: Less than 100.

E. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

F. 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.

2.3 FABRICATION, GENERAL

A. Paneling Grade: Provide Custom grade paneling complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of the referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication to maximum extent feasible, before shipment to Project site. Disassemble components only as necessary for shipment and installation.

D. Neatly cut openings to receive 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 and seal with clear waterproofing agent.

2.4 PLASTIC-LAMINATE-CLAD PANELS

A. Quality Standard: Comply with AWI Section 500.

B. Plastic-Laminate Cladding: High-pressure decorative laminate, color(s) and finish as scheduled:

1. Faces: Type VGF.
2. Backs: Type BKV.
3. Panel Edges: PVC edging in color to match panel face.

C. Panel Core Construction: Fire-retardant high-density particleboard.

D. Fire-Retardant-Treated Paneling: Provide panels consisting of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have a flame-spread rating of 75 or less and a smoke-developed rating of 450 or less per ASTM E 84.

E. Finish Sizes:
1. Overall finish panel thickness shall be 7/16 inch minimum.
2. Panel face size(s) shall be as indicated in the drawings.

F. Accessories:
1. Panel anchors: Panel manufacturer's recommended formed steel or extruded aluminum zee clips specially designed for panel mounting. Zee clips shall provide for 1/4-inch gap from face of mounting substrate to back of panel.
2. Divider moulding: No. 302.
3. Outside corner moulding, 90 degrees: No. 103-90, with end caps.
4. Trim moulding: No. 304.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition paneling to average prevailing humidity conditions in installation areas before installation.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

3.2 INSTALLATION

A. Quality Standard: Install panels to comply with AWI Section 1700 for the appropriate grade of materials.

B. Install continuous horizontal bands of 16-ga. x 4" wide sheet metal to metal wall studs prior to installation of gypsum board.
1. Fasten sheet steel band using minimum of (2) bugle-head drywall screws at each stud. Dimple sheet metal at screw locations for flush heads to avoid interference with gypsum board installation.
2. Provide continuous metal bands horizontally as required for mounting of panel zee-clip receivers using flat-head sheet metal screws or drywall screws.
   a. Fasten corresponding half of each zee clip to back of panel using flat-head wood screws.
   b. Each panel shall have a minimum total of (6) zee clips mounted to the horizontal mounting bands.

C. Install each panel with long length horizontal; level, plumb, true, and straight with no distortions and with all top and bottom edges in alignment.
1. Shim as required with concealed shims to ensure full length of each panel is flush with adjacent panel. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Install each panel flush with adjacent panels.
3. Install self-adhesive foam backer spacers where required to keep panel mounts tight without rattle.

3.3 ADJUSTING AND CLEANING

A. Adjust installed panels where necessary to provide uniform gaps between panels, all top edges level and in alignment, and with all panel edges flush with each adjacent panel edge.

B. Replace any panels that are damaged during installation or prior to Owner acceptance.

C. Clean exposed surfaces of panels and deliver to the Owner recommended cleaner in quantity suitable for a minimum of 50 cleanings.

END OF SECTION

SECTION 06 61 16 - SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast plastic fabrications.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry.
   2. Section 06 61 13 – Quartz Surfacing Fabrications

1.2 REFERENCES

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

   3. PRODUCT-SPECIFIC SUBMITTALS

B. Section 013300 - Submittal Procedures: Submittal procedures.

C. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, methods of support, integration of plumbing and electrical components, and anchorages.

D. Product Data: Submit data on specified component products.

E. Samples: Submit two samples, 6 x 6 inch in size illustrating each color, texture, and finish.

F. Manufacturer's Installation Instructions: Submit preparation of opening required, rough-in sizes, and tolerances for item placement.

1.3 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required, and list of substances harmful to component materials. Include instructions for stain removal and surface and gloss restoration.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ documented experience.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 MAINTENANCE

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two containers of 16 oz of polishing cream.

PART 2 - PRODUCTS

2.1 SOLID SURFACING FABRICATIONS

A. Manufacturers
1. Wilsonart; www.wilsonart.com

B. Basis of Design: *Aspen Quartzite 9245SS* as manufactured by Wilsonart, or approved equivalent by specified manufacturer.
1. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Resin: Acrylic resin-based, non-porous, stain resistant.

B. Adhesive: Clear methacrylate type, cartridge dispensed.

2.3 FABRICATION

A. Polish exposed surfaces to honed finish.

B. Radius corners and edges.

C. Provide uniform ½" thick material unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

A. Provide anchoring devices for installation.

B. Provide templates and rough-in measurements.

3.3 INSTALLATION

A. Align work plumb and level.

B. Rigidly anchor to substrate to prevent misalignment.

C. Seal to adjacent construction in accordance with Section 079000.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Indicated Dimension: 1/8 inch.

B. Maximum Offset from Indicated Position: 1/8 inch.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Clean work under provisions of 017000.

C. Clean and polish surfaces.

END OF SECTION

SECTION 06 61 19 – QUARTZ SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes quartz-based fabricated stone countertops for reception desk and other fabrications as may be indicated in the drawings.

B. Related Sections:
   1. Section 06 20 53 – Interior Finish Carpentry and Millwork: Base cabinet countertop support.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM C373 – Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity.
   3. ASTM C170 - Standard Test Method Compressive Strength of Dimension Stone.
   4. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
   5. NEMA LD3-3.6 – Ball Impact Resistance.
   6. NEMA LD3-3.6 – High Temperature Resistance.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, methods of support, integration of plumbing and electrical components, and anchorages.

C. Product Data: Submit data on specified component products.

D. Samples: Submit two samples, 12 12 inch in size illustrating each color, texture, and finish.

E. Manufacturer's Installation Instructions: Submit preparation of opening required, rough-in sizes, and tolerances for item placement.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit list of approved cleaning materials and procedures required, and list of substances harmful to component materials. Include instructions for stain removal and surface and gloss restoration.

1.5 WARRANTY:

A. Provide manufacturer’s limited commercial 10-year warranty against product defects.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years’ documented experience.

B. Installer: Fabricated and installed by manufacturer’s certified fabricator/installer with a minimum of 5-years’ experience in similar installations. Provide manufacturer’s written certification with assurance of manufacturer’s warranty.

PART 2 - PRODUCTS

2.1 QUARTZ SURFACING FABRICATIONS

A. Manufacturers:
1. Consentino Silestone, www.silestone.com.
2. Corian Quartz, www.corianquartz.com
3. Ice Stone LLC, www.icestoneusa
4. Prestige Stone Quartz Surfacing, Building Plastics, Inc., www.bpiteam.com
5. Zodaq Quartz Surfaces, DuPont, www.dupont.com
6. Substitutions: Section 016000 - Product Requirements.

B. Basis of Design: *Corian Quartz*® (formerly *Zodiaq*®) or approved equivalent by specified manufacturer.

C. Performance Characteristics
1. Fire Resistance per ASTM E84 (UL 723).
a. Surface Burning Characteristics: Class A (Class 1)
b. Flame Spread Resistance: 25 or less.
c. Smoke Developed Index: 450 or less.
2. Water Absorption: Less than 0.04% short term; less than 0.12% long term per ASTM C373.
3. Density: 2.2 - 2.4 g/cm^3 per ASTM D792.
4. Impact Resistance: No failure at 164 inches NEMA LD 3-3.8.
5. Abrasion Resistance: 139 or better per ASTM C501.
6. Stain Resistance: Passes ANSI Z124.
7. High Temperature Resistance: Passes NEMA LD3-3.6
8. Impact Resistance: No failure at 164 inches NEMA LD 3-3.8.

D. Selection(s): Reference the Interior Materials Schedule.

2.2 COMPOSITION

A. 93 percent crushed quartz aggregate combined with resins and pigments fabricated into slabs using a vacuum vibro-compaction process.

B. Color: As selected by the Architect from manufacturer’s full range of standard and custom colors for polished finish.

2.3 SHOP FABRICATION

A. Finished Slab Thickness: 3/4-inch or 1-1/4-inch as indicated in the drawings.

B. Slab Sizes: As indicated.

C. Identification: Each slab shall be labeled with fabricator’s batch number and imprinted with manufacturer’s identifying mark on the back side.

D. Polish exposed surfaces to manufacturer’s “Polished” finish with gloss rating of 35%.

E. Beveled or slightly radiused corners and edges.

F. Provide all necessary cut-outs. Obtain templates from plumbing subcontractor for fittings, sinks, and lavatories. Provide cut-outs with minimum 3/8” inside corner radius. Reinforce any remaining material less than 3-inches wide with concealed strip(s) of quartz panels.

G. Laminate layers of quartz surfacing as required to create built-up edges or other areas requiring additional thickness as indicated in the drawings.

2.4 ACCESSORIES

A. Mounting Adhesive: Silicone or 2-component epoxy as determined by the installer for the particular installation.
   1. Color: Adhesive that will be visible in finished work shall be tinted to match quartz surfacing.
   2. Provide spacers where required by the adhesive manufacturer for the particular installation.

B. Joint Sealants: Clear silicone sealant by Dow Corning or General Electric as recommended by the manufacturer for the specific application and conditions of use. Provide anti-bacterial type at restrooms and food preparation areas.

PART 3 - EXECUTION

3.1 STORAGE AND HANDLING

A. Store in racks in near-vertical position, indoors and away from direct exposure to sun or other heat source.

B. Protect against warpage and breakage.

C. Store with finished face turned toward finished face and separated by heavy paper or cardboard.

3.2 EXAMINATION

A. Reference Section 013000 - Administrative Requirements: Coordination and project conditions

B. Field-verify all relevant dimensions prior to beginning fabrication.

C. Verify that substrates supporting quartz surfacing are plumb, level, and within plane to within 1/16-inch per ten-ft., and that necessary supports and blocking are in place.

D. Ensure that base cabinets are securely fixed to adjoining units and back wall.

E. Verify joint preparation and affected dimensions are acceptable.

3.3 INSTALLATION

A. Align work plumb and level.

B. Rigidly adhere or physically anchor finished panels in concealed manner to prevent movement or misalignment.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Indicated Dimension: 1/8 inch.

B. Maximum Offset from Indicated Position: 1/8 inch.

3.5 FINAL CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean and polish all exposed surfaces of quartz surfacing.

C. Furnish to the Owner (2) 16 oz. or larger containers of manufacturer’s recommended non-abrasive, low pH cleaning and polishing agent.

END OF SECTION

SECTION 07 13 00 - SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes self-adhering rubberized asphalt sheet waterproofing and protective cover.
   1. For installation at below-grade walls such as elevator pits.

B. Related Sections:
   1. Section 07 90 00 - Joint Protection.
   2. Section 14 24 23 – Hydraulic Passenger Elevators: Waterproofing of elevator pits

1.2 REFERENCES

A. ASTM International:
   1. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers -Tension.
   2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Roofing Contractors Association:
   1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

1.3 SYSTEM DESCRIPTION

A. Waterproofing System: Capable of resisting water under positive pressure and preventing moisture migration to interior.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

C. Product Data: Submit data for surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants, with temperature range for application of waterproofing membrane.

D. Samples: Submit 12 x 12 inch samples of waterproofing sheet and protection board.

E. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Waterproofing Manual and manufacturer’s instructions.

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing work of this section and who is authorized by the manufacturer to install manufacturer’s products.

1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for waterproofing failing to resist penetration of water.

C. For warranty repair work, remove and replace materials concealing waterproofing.

PART 2 - PRODUCTS

2.1 SHEET MEMBRANE WATERPROOFING

A. Manufacturers:
1. Bituthene System 4000, W. R. Grace & Co., www.grace.com
2. Mel-Rol, W. R. Meadows, Inc., www.wrmeadows.com
3. Miradri, T. C. Miradri, www.miradi.com
4. Duramem 700-SM, Pecora Corporation, www.pecora.com
5. Polyguard 650, Polyguard Products, Inc., www.polyguardproducts.com
6. TW-60, Tamko Roofing Products, Inc., www.tamco.com
7. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Rubberized Asphalt Membrane: Self-adhering sheet consisting of 56 mils rubberized asphalt laminated to a 4 mil thick polyethylene film with release liner on adhesive side, conforming to following criteria:

Properties	Test	Results
Tensile Strength	ASTM D412	250 psi
Elongation	ASTM D412	300 percent
Low-Temperature Flexibility	ASTM D1970	Pass at minus 20 deg F
Puncture Resistance	ASTM E154	40 lbf
Water Absorption	ASTM D570	0.15 percent weight gain
Moisture Vapor(perms)	ASTM E96	0.05 perms
Hydrostatic-Head Resistance	ASTM D5385	150 feet

2.3 ACCESSORIES

A. Surface Conditioner: Waterborne latex type, compatible with membrane.

B. Primer: Liquid, rubber-based primer recommended by manufacturer.

C. Liquid Membrane: Elastomeric, cold-applied, trowel grade, designed for use with sheet waterproofing.

D. Sealant: As specified in Section 07 90 00.

E. Protection Board: Rigid asphaltic-composition board, nominal 1/4-inch thick, or structural insulating board conforming to ASTM C208.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items penetrating surfaces to receive waterproofing are securely installed.

D. Verify substrate surface slopes to drain for horizontal waterproofing applications.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer or applicator.

D. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer.

E. Apply surface conditioner at rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

3.3 INSTALLATION - SELF ADHERED MEMBRANE WATERPROOFING

A. Roll out membrane. Minimize wrinkles and bubbles.

B. Remove release paper layer. Roll out on substrate with mechanical roller to encourage full contact bond.

C. Lap sides and ends.

D. Overlap edges and ends minimum 3 inches and seal with contact adhesive. Seal permanently waterproof.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams. Coordinate with drain installation.

G. Seal membrane to adjoining surfaces.

H. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface laid in shingle fashion.

I. Seal items protruding to or penetrating through membrane.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit traffic over unprotected or uncovered membrane.

C. Protect membrane from damage by adhering protection board immediately after membrane placement.

D. Carefully backfill and compact so as not to damage or dislodge protection board.

END OF SECTION

SECTION 07 19 16 – CONCRETE FLOOR CLEAR FINISH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water-based clear finish for interior concrete floors to remain exposed.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete slab-on-grade surfaces, curing agents, and floor hardeners.
   2. Section 07 90 00 - Joint Protection: Sealants

1.2 SYSTEM DESCRIPTION

A. Applied Finish: Material to restrict moisture absorption and provide slip-resistant and abrasion-resistant finished appearance for interior concrete flooring indicated to remain exposed.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit details of product description, tests performed, limitations to coating, and chemical properties including percentage of solids.

C. Samples: Of each substrate indicated to receive water repellent, 12 inches square, with specified repellent treatment applied to half of each sample.

D. Manufacturer's Installation Instructions: Submit special procedures and conditions requiring special attention, and cautionary procedures required during application.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements, including local requirements controlling the emission of VOCs.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section for a minimum of three years.

B. Applicator: Company specializing in performing Work of this section with minimum three years’ experience and approved by manufacturer for this application.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect product from freezing.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply coating when ambient or surface temperature is lower than 40 degrees F or higher than 100 degrees F.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish manufacturer's written warranty for sealer/finish for a minimum of two-years after Substantial Completion of Project.

PART 2 - PRODUCTS

2.1 Manufacturers:

A. Euclid Chemical Company, www.euclidchemical.com.
B. L.M. Scofield Company, www.scofield.com
C. W.R. Meadows, www.wrmeadows.com
D. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Concrete Sealer: Water-based clear and colorless high solids type sealer and finish that is VOC-compliant.
   1. Basis-of-Design: *Selectseal Plus* as manufactured by Scofield.
   2. VOC Content: less than 100 g/L.
   3. Semi-Gloss or Gloss finish.
   4. High solids content; low odor.
   5. Certified wet-slip resistant per UL 410.
   6. Abrasion-resistant.
   7. Apply at interior concrete floors scheduled to remain exposed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of coating.

D. Obtain product information from Contractor for curing agent that was used on floors scheduled to receive a clear finish coat to ensure that the proposed finish coat is compatible.

E. Test the surface of concrete before applying sealer/finish ensure it absorbs drops of water within 20-30 seconds. Verify with the sealer/finish manufacturer whether a non-absorbing surface will require mild acid-etching prior to sealer/finish application.

3.2 PREPARATION

A. Delay Work until concrete substrate is cured minimum of 60 days, and all other trades have completed work in the affected areas.

B. Remove loose particles and foreign matter. Remove oil or foreign substances that may interfere with appearance or performance of sealer/finish. Remove drywall compound and paint drips by scraping.

C. Remove curing agents remaining on surface of affected slabs. Ensure compatibility of curing agent and any installed joint sealants with proposed sealer/finish product.

D. Scrub and rinse surfaces with water and let dry while restricting foot traffic. Vacuum dry surface just prior to application of sealer/finish.

E. Test for pH level of substrate before applying. Do not apply to substrates with pH level outside of manufacturer's recommended limits.

F. Protect adjoining work, including sealant bond surfaces at joints. Mask-off wall bases and adjoining surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces.

G. Coordination with Sealants and Hardeners:

1. Coordinate with concrete hardener applied under the Cast-In-Place Concrete section to ensure compatibility.
2. Coordinate with sealant manufacturer to determine whether sealer/finish should be applied prior to or after installation of any joint sealants in concrete slab. Sealant joints installed prior to application of sealer/finish shall be fully cured.
3. Sealer/finish application may precede joint sealant installation only if sealant adhesion and compatibility have been tested and verified.

3.3 APPLICATION

A. Apply in accordance with manufacturer's instructions.

B. Apply a saturation coating of clear sealer/finish on indicated surfaces using foam, microfiber, or lamb's wood applicators. Cover all surfaces to remain exposed.

C. Apply second coat in accordance with manufacturer's directions for drying and scuffing of first coat. Final coat shall be free of lap or brush marks.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Immediately remove sealer/finish from adjacent surfaces by methods as instructed by coating manufacturer. Repair damage to surfaces not indicated to receive sealer/finish.

END OF SECTION

SECTION 07 21 13 – THERMAL WALL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes
   1. Rigid board insulation at exterior masonry or steel stud cavity wall construction.
   2. Blanket insulation in parapet construction, above exterior soffits, behind metal panels, and other specific areas as specifically indicated.
   3. Loose fill insulation within single-wythe exterior walls where other forms of insulation are not practical.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry Assemblies: Cavity wall construction.
   2. Section 07 27 13 – Fluid Applied Membrane Air Barrier.
   3. Section 09 21 16 – Gypsum Board Assemblies.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C549 – Standard Specification for Perlite Loose Fill.
   2. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for product characteristics, performance criteria, and limitations.
   1. Provide product data indicating fire-test-response characteristics in accordance with the following, or similar testing and inspecting agency acceptable to authorities having jurisdiction:
      a. Identify materials with appropriate markings of applicable testing and inspecting agency.
      b. Surface-Burning Characteristics tested per ASTM E84.
      c. Fire-Resistance Ratings tested per ASTM E119.
      d. Combustion Characteristics tested per ASTM E136.
   2. Provide product data indicating thermal characteristics.

C. Manufacturer's Installation Instructions: Submit special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
   1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install adhesives when temperature or weather conditions are detrimental to successful installation.

1.6 SEQUENCING

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

B. Sequence Work to ensure dampproofing or air barrier materials are in place before beginning Work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources.
   1. Store inside and in a dry location.
   2. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
   3. Protect plastic insulation as follows:
      a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
      b. Protect against ignition at all times.
      c. Do not deliver plastic insulating materials to Project site before installation time.
      d. Once started, complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 CAVITY WALL BOARD INSULATION

A. Polyisocyanurate
   1. Manufacturers
      a. *EnergyShield PRO2:* Atlas Wall Board, www.atlaswall.com
      b. *Ecomax ci:* Rmax, www.rmax.com
      c. *EnergyGuard*: GAF Corp., www.gaf.com
      d. Thermax: Dow Chemical USA, www.dow.com
      e. XCI Class A: Hunter Panels www.hunterxci.com

   2. Components: Rigid Polyisocyanurate Insulation Board with glass fiber reinforced aluminum facers on both sides:
      a. Board size: 16 x 96 inches.
      b. Board Thickness: 2- inches or as indicated in the drawings.
      c. Thermal Resistance: - year aged R-value of 5.0 or better per inch thickness.
      d. Tested and meeting requirements of NFPA 285-(06) in commercial assemblies.

B. Applications:
   1. Polyisocyanurate Board:
      a. Use at metal panel surfaced walls as required to meet NFPA285-(06).

   2. Protection: All plastic insulation boards must be utilized, detailed, and protected in accordance with requirements of NFPA285-(06) and applicable governing authorities.

C. Accessories
1. Adhesive: Type recommended by insulation manufacturer for application. Ensure compatibility with applied air barrier material.

2.2 SINGLE WYTHE LOOSE FILL INSULATION

A. Thermal Insulation Within Masonry Cells: Loose granular perlite, ASTM C549 Type II.
1. Inert volcanic white granular glass material expanded by heat process and treated to improve water repellency.
2. Dry loose weight density of 2.0 - 11.0 lbs./cu.ft.
3. Basis of Design: *Loose-Fill Masonry Insulation* as manufactured by Ryolex® or approved equivalent.

B. Applications:
1. For special applications only where specifically indicated in the drawings.

2.3 BLANKET INSULATION

A. Manufacturers:
1. CertainTeed Corporation www.certainteed.com
2. Johns Manville Corporation. www.jm.com
3. Owens Corning. www.owens-corning.com
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Type: ASTM C665; preformed glass fiber blankets; friction fit, conforming to the following:
1. Thermal Resistance: Minimum R-value of 19.
2. Thickness: 6 inches.
3. Width: 12 and 16 inches wide, as needed for the particular stud spacing.
4. Facing: Unfaced.

C. Applications:
1. For special applications where specifically indicated in the drawings.
2. Typically behind metal panels or stucco/plaster, or within exterior soffit areas.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation.

C. Verify wall ties are properly spaced and ready to receive insulation.

3.2 INSTALLATION – BOARD INSUALTION at CAVITY WALLS

A. Apply adhesive to substrate.

B. Install boards horizontally between wall ties.

C. Stagger end joints. Butt edges and ends tight to adjacent boards.

D. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

3.3 LOOSE FILL INSULATION

A. Install only at single-wythe masonry walls where board insulation or blanket insulation is not practical.

B. Pour insulation directly from the bag or hopper directly into the open cells of the masonry units as wall construction progresses. Do not exceed four installed courses per each installation of loose-fill to ensure filling of all open masonry cells.

C. Ensure that all wall openings are sealed prior to installing loose fill to ensure against leakage of installed fill.

D. Provide copper screen mesh bridging within walls as required to prevent any self-supporting pour from exceeding 20 feet in height.

E. Fill all walls completely and to full height

3.4 BLANKET INSULATION

A. Install only at areas where board insulation or loose fill insulation is not indicated.
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
   4. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. 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

SECTION 07 27 26 – FLUID-APPLIED MEMBRANE AIR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cold applied water-resistant vapor permeable air barrier at exterior wall assemblies.

B. Related Sections include the following:
1. Section 04 20 00 - Unit Masonry Assemblies: Concrete masonry unit backup.
2. Section 07 21 13 - Thermal Wall Insulation: Board insulation and compatibility.
3. Section 09 21 16 “Gypsum Board Assemblies” for exterior sheathing board.

1.2 REFERENCES

A. ASTM International:
1. ASTM E 2178 - Standard Test Method for Air Permeance.
2. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
3. ASTM D 4541 – Standard Test Method for Pull-Off Strength of Coatings.
4. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
5. ASTM D 2369 – Standard Test Method for Volatile Content of Coatings.
6. ASTM D 4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
7. ASTM E 154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
8. ASTM E 162 Test Method for Surface Flammability of Materials Using a Radiant Heat Source.
9. ASTM E 1186 Practice for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems.
10 ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
11 ASTM C 920 Specifications for Elastomeric Joint Sealants.
12 ASTM C 1193 Guide for Use of Joint Sealants.
13 ASTM D 570 Test Method for Water Absorption of Plastics.
14 ASTM D 1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
15 ASTM D 1876 Test Method for Peel Resistance of Adhesives.
16 ASTM D 1938 Test Method for Tear Propagation Resistance of Plastic Film and Sheeting.
17 ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
18 ASTM D 4258 Practice for Surface Cleaning Concrete for Coating.

B. National Fire Protection Association (NFPA)
1. NFPA 285 – Fire propagation test that evaluates the fire performance of exterior wall assemblies contining combustible components.

1.3 SUBMITTALS

A. General Submittal Requirements: Reference Section 01 33 00 - Submittal Procedures.

B. Product Data: For each type of product specified, submit manufacturer’s product data, installation instructions, and manufacturer’s printed instructions for evaluating, preparing, and treating substrate, temperature, and other limitations of installation conditions, technical data, and tested physical and performance properties.
1. Obtain primary materials from a single manufacturer regularly engaged in manufacturing vapor permeable air barrier materials. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.

2. Include statement that all proposed air barrier materials are permanently chemically compatible with all proposed adjacent materials.
3. Include statement that successful field peel-adhesion tests on all materials to which sealants are proposed to be adhered have been performed.
4. Include statement that products comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.
5. Submit manufacturer's printed documents verifying product has met testing requirements of NFPA 285 in wall assemblies pertaining to this Project.

C. Quality Assurance:
1. Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification numbers of proposed installers.

D. Manufacturer's Installation Instructions:
1. Submit special procedures and perimeter conditions requiring special attention.
2. Submit requirements for conditions, preparation, and any details of construction required for substrates installed by other trades in order to provide substrate installations suitable for the work under this section.
3. Submit manufacturer's recommended dry film thickness installation of fluid-applied membrane for this specific Project.

1.4 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Install membrane air barrier as part of the unit masonry mock-up specified in Section 04 20 00. Mock-up shall be nominal minimum 8 ft. long by 8 ft. high unless indicated larger in the drawings.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Ensure that ambient temperatures are above 40 degrees F and below 100 degrees F for 24 hours before and during application and until membrane has cured.

C. Do not install liquid-applied membrane in snow, rain, fog, or mist or when such conditions are expected within 24 hours of completed application. Do not install liquid-applied membrane when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the vapor permeable air barrier manufacturer.

1.6 PERFORMANCE REQUIREMENTS

A. Material performance: Provide materials that have an air permeance not to exceed 0.004 cu. ft. per minute per sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/m^2@75 Pa.) when tested in in accordance with ASTM E-2178.

B. Assembly Performance: Provide a continuous vapor permeable air barrier assembly that has an air leakage not to exceed 0.040 cu. ft. per minute per sq. ft. under a pressure differential of 0.3 in. water (1.57 psf) (0.20 L/m^2@75 Pa.) when tested in in accordance with ASTM E-2357.
1. Assembly shall be capable of withstanding combined positive and negative design wind, fan, and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure.
2. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory vapor permeable air barrier materials at such locations, changes in substrate, and perimeter conditions.
3. Assembly shall not displace adjacent materials under full load.

4. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, and any anticipated seismic movement. Connection shall be made between:
   a. Foundation and walls.
   b. Walls and windows or doors.
   c. Different wall systems.
   d. Wall and roof.
   e. Wall and roof over unconditioned space.
   f. Walls, floor and roof across construction, control and expansion joints.
   g. Walls, floors and roof to utility, pipe and duct penetrations.

5. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.

C. System is not suitable for waterproofing applications in hydrostatic condition.

D. System is not compatible with petroleum solvents, fuels and oils, materials containing creosote, pentachlorophenol, or linseed oil.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacturer, and any special directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location within temperature range recommended by the manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with manufacturer's recommendations.

1.8 WARRANTY

A. Material Warranty: Provide Manufacturer's standard form in which manufacturer agrees to replace fluid-applied air barrier membrane materials that fail within specified warranty period when installed and used in accordance with manufacturer's written instructions.
   1. Failures include, but are not necessarily limited to the following:
      a. Failure to maintain air permeance rating not to exceed .004 cfm/sq. ft (0.02 L/s/sq. m.) when tested per ASTM E2178, within specified warranty period.
      b. Failure to maintain a vapor permeance rating greater than 10 perms when tested in accordance with ATM E96, Method B.
   2. Warranty Period: Minimum of 5-years from date of Substantial Completion of the Project

B. Installer's Warranty: Provide air barrier subcontractor's material and installation warranty for a minimum of 2-years from date of Substantial Completion of the Project. Warranty shall cover all components of the air barrier assembly against failure including loss of airtight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

1.9 PRE-INSTALLATION CONFERENCE

A. A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Pre-installation conference shall include the Contractor, installer, Architect, system manufacturer's field representative, and Owner's building envelope consultant. Agenda for meeting shall include but not be limited to the following:
   1. Review of Submittals.
   2. Review of surface preparation, minimum curing period and installation procedures.
   3. Review of special details and flashings.
   4. Sequence of construction, responsibilities and schedule for subsequent operations.
   5. Review of mock-up requirements.

6. Review of inspection, testing, protection and repair procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer shall be a firm with a minimum of 10-years' experience in the production and sales of waterproofing and air barriers. Manufacturers proposed for use, but not named in these specifications shall submit evidence of ability to meet all requirements specified and include a list of projects of similar design and complexity completed within the past five years.
   1. Grace Construction Products: *Perm-A Barrier VPL.*
   2. Henry Company, Inc.: *Air Bloc 31MR.*
   3. Polyguard Products, Inc.: *Airlok Flex VP.*
   4. Prosoco *R-Guard MVP*.
   5. STO: *EmeraldCoat*.
   6. Tremco, Inc.: *ExoAir 230.*
   7. W.R. Meadows, Inc: *Air-Shield LMP*
   8. Substitutions: Section 01 25 00 – Substitution Procedures – products must meet NFPA 285 requirements for the wall assembly.

2.2 SYSTEM COMPONENTS: Basis of Design: *Perm-A-Barrier* as manufactured by Grace Construction Products or approved equivalent by specified manufacturer.

A. Fluid-Applied Membrane: Single component acrylic vapor-permeable air barrier membrane, resulting in minimum 30-mil dry thickness.
   1. Basis of Design: *Perm-A Barrier VPL* Class ll vapor retarder as manufactured by GCP Applied Technologies (Formerly Grace Construction Products), or approved equivalent by specified manufacturer.
   2. Air permeance: Less than 0.004 cfm/ft^2 per ASTM E2178.
   3. Water vapor transmission: Not less than 11.2 perms (649.6 ng/Pa x s x sq. m); when tested in accordance with ASTM E96.
   4. Pull adhesion to glass faced wall board: 25 psi or greater per ASTM D4541.
   5. Tensile strength: 15 psi or greater per ASTM D412.
   6. Solids content: Minimum 50% by volume or weight per ASTM D2369.
   7. UV exposure limit: Not more than 180 calendar days; per ASTM D412 and ASTM E96-Method B.

B. Transition Membrane: *Perm-A-Barrier Detail Membrane*, fully adhered; must be provided by membrane system manufacturer.

C. Through-Wall Flashing: *Perm-A-Barrier Wall Flashing*: 0.8 mm (32 mils) of rubberized asphalt integrally bonded to 0.2 mm (8 mil) of cross-laminated, high-density polyethylene film to provide a min. 1.0 mm (40 mil) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:
   1. Water Vapor Transmission: ASTM E96, Method B: 2.9 ng/m2sPa (0.05 perms) max.
   2. Water Absorption: ASTM D570: max. 0.1% by weight
   3. Puncture Resistance: ASTM E154: 356 N (80 lbs.) min.
   4. Tear Resistance:
      a. Initiation ASTM D1004: min. 58 N (13.0 lbs.) M.D.
      b. Propagation ASTM D1938: min. 40 N (9.0 lbs.) M.D.
   5. Lap Adhesion at -4ºC (25ºF): ASTM D1876: 880 N/m (5.0 lbs./in.) of width
   6. Low Temperature Flexibility ASTM D1970: Unaffected to -43ºC (-45ºF)
   7. Tensile Strength: ASTM D412, Die C Modified: min. 5.5 MPa (800 psi)
   8. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200%.

D. Primer: Water based *Perm-A-Barrier Primer Plus* or *WB Primer*.

E. Penetrations, terminations, and detailing sealant: *Bituthene Liquid Membrane*.

F. Joint Sealant: As recommended by the primary system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of air barrier system. Verify items penetrating substrate are securely anchored and prepared to receive air barrier system.

C. Ensure the following conditions:
1. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants.
2. Concrete surfaces are cured and dry, smooth without large voids, loose aggregate, spalled areas, or sharp protrusions.
3. Masonry joints are full, flush, and completely filled with mortar, and all excess mortar on masonry ties has been removed.
4. Confirm mortar is tooled full and flush at pintel ties embedded in CMU joints.
5. Corners and edges of drywall sheathing panels are properly screw-fastened to avoid any deflection in the final membrane, and all fastener heads are driven flush with the panel surface.
6. Substrate dryness meets air barrier system manufacturer’s requirements. Test for capillary moisture in substrate by plastic sheet method according to ASTM D 4263.

D. Verify sealants used in sheathing installation are compatible with proposed air barrier membrane. Perform field peel-adhesion test on materials to which sealants are adhered.

E. Beginning air barrier system installation indicates acceptance of substrate conditions.

3.2 PREPARATION

A. During wall construction install embedded flashings including all membrane through-wall flashings where indicated and as necessary for successful air barrier installation. Install membrane flashing over vertical and horizontal legs of steel shelf angles and over transition between vertical leg and sheathing or CMU substrate.

B. Protect adjacent construction and surfaces not designated to receive air barrier system.

C. Clean loose dust and dirt from surfaces to receive air barrier system by brushing or use of a clean dry cloth.

D. Do not apply membrane or sealants to surfaces unacceptable to air barrier system manufacturer without corrective action.

E. Fill surface irregularities, voids, and joints in substrate as recommended by system manufacturer, with particular attention to expansion and construction joints. Remove any high spots to ensure uniform surface.

F. On highly dusty or porous substrates apply a scratch coat of liquid membrane prior to spraying to full thickness.

G. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and protrusions.

H. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.3 INSTALLATION

A. General: Install transition strip materials and fluid-applied vapor-permeable air and liquid water barrier to prevent air infiltration and exfiltration through the exterior wall construction without prohibiting the movement of water vapor through the wall.
1. Install materials in accordance with manufacturer’s printed instructions, the approved

submittals, and as specified herein.

2. Do not allow materials to come in contact with other chemically incompatible materials.
3. Prime substrates prior to application of self-adhering air barrier transition membrane/flashing.
4. Roll entire surface of self-adhering air barrier transition membrane/flashing with hand-held roller.
5. To ensure proper adhesion to polyethylene surfacing, apply primer on areas of self-adhering membrane at locations where fluid-applied air barrier will be applied to top surface of membrane.
6. Apply self-adhering membrane finger flashing around wall penetrations extending minimum 2-inches onto penetration and onto fluid-applied air barrier.
7. Apply sealant or liquid membrane along edges and seams of self-adhering membrane.
8. Applicator shall perform and record wet-mil thickness measurements during application per every 200 sq. ft. of application and submit record of findings to the Owner, Architect, and General Contractor.

B. Reinforcement and Joint Treatments
1. Reinforce joints, corners, and changes in plane of substrate using air barrier system manufacturer's approved transition membrane and sealant.
2. Tape all vertical and horizontal joints in gypsum sheathing using 2-inch wide x continuous mesh wallboard tape or approved transition membrane as recommended by the system manufacturer. Joint gaps greater than 1/4" wide shall be filled with approved mastic or caulk and allowed to fully cure before application of tape. Ensure that open-mesh tape and any remaining joint gap is fully filled with specified-applied membrane material.

C. Priming:
1. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Prime all wood, metal, painted and shop coated substrates.
2. Apply as many coats as necessary for proper adhesion.
3. Prime masonry or concrete substrates with conditioning primer for fluid-applied vapor permeable air barrier as recommended by system manufacturer. Apply as many coats as necessary for proper adhesion. Provide adequate drying time between coats.
4. Prime glass-fiber faced gypsum sheathing with number of coats as required to achieve proper bonding. Provide adequate drying time between coats.

D. Detailing:
1. Connect vapor permeable air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors, and other intersection conditions, and perform sealing of penetrations using accessory materials in accordance with system manufacturer's recommendations and approved submittals.
2. Transitions to beams, columns, and similar appurtenances shall be made with system manufacturer's transition membrane.
3. Apply transition strips and flashing to shed water naturally. Seal all sheet edges with permanently flexible termination mastic.
4. Install transition strips in shingle fashion so that any subsequent sheet overlaps sheet below by a minimum of 2-inches. Overlap horizontally adjacent transition strips a minimum of 2-inches. Roll overlaps into place using hand roller.
5. Seal all penetrations with termination mastic, extruded silicone sealant, membrane counter flashing or other material approved by the system manufacturer and the approved submittals.
6. At changes in substrate plane install approved transition material of sealant, mastic, membrane counter flashing or other material approved by the system manufacturer and the approved submittals. Eliminate all sharp 90-degree inside corners and provide a smooth transition from one plane to another.

7. At through-wall flashings provide an additional 6-inch wide strip of manufacturer's recommended membrane counter flashing to seal top of through-wall flashing to fluid-applied membrane. Seal top edge of strip with bead of approved sealant or mastic.
8. At expansion and control joints provide backup for the membrane to accommodate anticipated movement. Provide transition at all joint assemblies.
9. Apply a continuous bead or trowel coat of mastic along membrane seams at reverse-lapped seams, rough cuts, and as recommended by the manufacturer and the approved submittals.
10. Membrane shall be continuously supported by substrate. Provide mechanically fastened non-corrosive sheet metal to span gaps in substrate plane and to make smooth transition from one plane to another.
11. At the end of each working day, seal top edge of self-adhered membrane to substrate with termination mastic.

E. Fluid-Applied Membrane:
1. Ensure that all detailing of wall and sheathing is completed prior to applying the full coverage of fluid-applied membrane.
2. Apply fluid-applied vapor permeable air barrier using spray equipment and methods as required to achieve at a minimum the specified dry film thickness. Dry mil thicknesses thinner than specified shall not be acceptable even if tested and allowed by the system manufacturer.
3. Spray number of coats as required to achieve the specified dry film thickness. Allow for required drying time between each coat.
4. Make frequent wet mil thickness measurements as required during application to ensure application thickness will yield specified dry mil thickness requirements.

F. Inspection
1. Installer shall arrange for system manufacturer's field representative shall make a minimum of three inspection trips to the jobsite to review processes and work completed. Owner's building envelope consultant shall be advised a minimum of 5-days in advance of manufacturer's inspection trips. Manufacturer's representative shall provide written report of relevant observations to the Contractor:
   a. At work commencement.
   b. At nominal 50% completion.
   c. Just prior to system cover-up.
2. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight. Installer shall inspect completed system with manufacturer's field representative and Owner's building envelope consultant just prior to cover-up and make corrections to any tears, scuffs, cracks, penetrations, or other damage as directed by the manufacturer.

3.4 CLEANING AND PROTECTING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and materials.

B. Inspect installation just prior to final covering of system, and repair punctures, tears, damaged areas, and inadequately lapped seams with patches of membrane lapped and sealed per manufacturer's recommendations.

C. Coordinate scheduling with installation of cover materials to ensure that membrane is not exposed to sunlight longer than recommended by the system manufacturer. Board insulation shall not be installed until fluid-applied membrane is fully cured.

END OF SECTION

SECTION 07 42 13 - METAL SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Prefinished steel soffit panel system with concealed fasteners.
   2. Related flashings and accessory components.

B. Related Sections:
   1. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   2. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

1.3 PERFORMANCE REQUIREMENTS

A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure as calculated in accordance with applicable code.

B. Maximum Allowable Deflection of Panel: 1/180 of span.

C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.

C. Product Data: Submit data on panels.

D. Samples:
   1. Submit two samples of each type panel and panel finish, 12 x 12 inch in size, illustrating panel profile and finish color, sheen, and texture.
   2. Submit two samples of fasteners, closures, and other accessories.

E. Manufacturer’s Installation Instructions: Submit special procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing Work of this section with minimum three years’ experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials capable of causing discoloration or staining.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installation of secondary cold form metal support framing.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Fluoropolymer Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal soffit panels within the specified warranty period and agreeing to repair finish or replace soffit panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
   1. Fluoropolymer Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL SOFFIT PANELS

A. Manufacturers - Prefinished Galvanized Steel Panels:
   1. AEP-Span www.aep-span.com
   2. Berridge Manufacturing Co. www.berridge.com
   3. Centria www.centria.com
   4. Metal Building Components, Inc. www.mbci.com
   5. Petersen Aluminum Corp. www.pac-clad.com
   6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 STEEL PANELS

A. Base Material: Prefinished galvanized steel sheet. ASTM A755/A755M coil coated
   1. Base Metal: ASTM A653/A653M; Structural Quality; G90 zinc coating.
   2. Exposed Finish: Premium three-coat fluoropolymer coating with minimum 70 percent polyvinylidene fluoride resin. Color(s) to be selected by the Architect.
   3. Unexposed Finish: Manufacturer's standard coating.
   4. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as panel sheets; brake formed to required profiles
   5. 20-year finish warranty.

B. Overhead Steel Soffit Panels:
   1. Minimum 22-gage prefinished steel stock.
   2. Interlocking flat profile without grooves to match Berridge “FW-12” Panel
   3. 11-5/8-inch face width with Vee grooves at 3-7/8 centers. Certain soffit panels to be vented as indicated in the drawings.
   4. Interlocking edges and ends butted tight. Provide with matching corner trim and

fascia.

5. Install with concealed fasteners.
6. Color to be selected by Architect from Manufacture’s full range of options.

2.3 ACCESSORIES

A. Sealants: Specified in Section 07 90 00; color to match siding.

B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, stainless steel; fastener cap same color as exterior panel.

C. Field Touch-up Paint: As recommended by panel manufacturer.

2.4 FABRICATION

A. Form sections to shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest practicable lengths.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panels in accordance with manufacturer’s instructions using manufacturer’s standard flashing and trim details unless modified by Drawings.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.

D. Field cutting panels by torch is not permitted.

E. Install soffit panels full width of soffit over open framing and fasten at maximum 16 inches on center. End joints in soffit panels are not allowed. Install panels with concealed fasteners.

F. Accessories: Install components necessary for complete soffit panel assembly, including trim, flashings, sealants, gaskets, and similar items.

G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

H. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20 feet on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.2 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove site cuttings from finish surfaces.

C. Remove protective films from panel surfaces within 60 days of installation.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 54 23 – MULTIPLY PVC KEE FLEECEBACK MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Work includes all labor, materials, equipment, and services necessary for installation of torch-applied SBS modified bituminous membrane and fleece-backed PVC KEE thermoplastic hybrid roofing system.

B. Related Sections:
1. Section 03 52 16 - Insulating Concrete Roof Fill: Requirements for insulating concrete as roofing deck.
2. Section 05 31 00 – Steel Decking: Acoustical metal deck at high gym,
3. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood nailers.
4. Section 07 62 00 - Sheet Metal Flashing and Trim: Sheet metal flashing and counterflashing.
5. Section 07 71 00 - Roof Specialties.
6. Section 07 72 33 - Roof Hatches.

1.2 REFERENCES

A. American Society of Civil Engineers:
1. ASCE-7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:
1. ASTM D41 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.
2. ASTM D312 Standard Specification for Asphalt Used in Roofing.
3. ASTM D1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
4. ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
5. ASTM D2822 Standard Specification for Asphalt Roofing Cement.
6. ASTM D4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet used in Roofing.
7. ASTM D5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
8. ASTM D6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials using Glass Fiber Reinforcements.
9. ASTM D 443 Standard Specification for Polyvinyl Chloride Membrane Sheet Materials
10. ASTM E108 Standard Test Methods for Fire Test of Roof Coverings.

C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. National Roofing Contractors Association:
1. NRCA - The NRCA Roofing and Waterproofing Manual.

E. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 790 - Tests for Fire Resistance of Roof Covering Materials.

1.3 SYSTEM DESCRIPTION

A. Multiply Roofing System: Roof assembly consisting of a smooth-surfaced torch SBS modified bituminous base-ply sheet and highly reflective PVC KEE fleeceback cap sheet ply.

B. Roof Deck: Insulating concrete roof fill and steel acoustic deck as indicated.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Conduct at Project Site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck 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 set up and mobilization areas for stored material and work area.
3. Review safety procedures and site-specific requirements relating to the work and areas to be accessed.
4. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
6. Review structural loading limitations of roof deck during and after roofing.
7. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
8. Review governing regulations and requirements for insurance and certificates if applicable.
9. Review temporary protection requirements for roofing system during and after installation.
10. Review roof observation and repair procedures after roofing installation.
11. Review notification procedures for weather or non-working days.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with not less than 5 years documented experience and have ISO 9001 certification.

B. Installer Qualifications: Company specializing in similar roofing system installation with not less than 5 years' experience and authorized by roofing system manufacturer as qualified to install manufacturer's roofing materials.

C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress. Supervisor/Foremen must be fluent in the English language and maintain proper supervision of workmen.

D. Maintain a copy of the Contract Documents in the possession of the Supervisor/Foreman and on the roof at all times.

E. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer.
1. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.
2. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.

F. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.

G. Engage the Manufacturer's Field Representative to conduct required periodic inspections of work in progress as described herein and shall furnish written documentation of all such inspections.

1.6 SUBMITTALS

A. Comply with pertinent provisions of Division 01 Section “Submittal Procedures, unless otherwise indicated.”

B. Manufacturer's Installation Instructions: Submit installation instructions and recommendations indicating special precautions required for installing the membrane.

C. Manufacturer's Certificate: Certify that roof system furnished is approved by Factory Mutual, Underwriters Laboratories, Warnock Hersey or approved third party testing facility in accordance with ASTM E108, Class [A] for external fire and meets local or nationally recognized building codes.

D. Manufacturer's Certificate: Certify that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.

E. Manufacturer's Certificate: Submit a certified copy of the roofing manufacturer's ISO 9001 compliance certificate.

F. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.

G. Written certification from the roofing system manufacturer certifying the applicator is currently authorized for the installation of the specified roof system.

H. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-16, Method 2 for Components and Cladding, In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article of this specification.

I. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner

1.7 CLOSEOUT SUBMITTALS

A. General: Comply with Requirements of Division 01 Section Closeout Submittals.

B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions: Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

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.

C. Discard and legally dispose of materials that cannot be applied within its stated shelf life.

D. 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.

E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 WARRANTY

A. Upon completion of installation, and acceptance by the Owner and Architect, the Manufacturer will supply to the Owner an “NDL” warranty, without monetary limitations in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Twenty (20) years from date of Substantial Completion.

B. Installer’s Warranty: Provide roofing installers warranty, to the membrane manufacturer, in which the roofing installer will, at his own 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.
   1. Warranty Period: Five (5) years from date of Substantial Completion.

1.10 MANUFACTURERS FIELD REPRESENTATION

A. Regularly scheduled site observations shall be required by the manufacturer’s field representative at an appropriate intervals during the roofing installation period; exceptions being made for inclement weather, holidays, etc.

B. All observation reports shall be kept current and shall be delivered electronically to the architect and contractor within five (5) calendar days after the observation. Progress payments for roofing work may be withheld if observation report submissions are not current.

C. Any failure by the Architect, the Owner’s Representative, the Project Manager, or the roofing manufacturer’s Technical Field Representative to observe, detect, pinpoint, or object to any defect or noncompliance with the requirements of the Roofing Manufacturer’s requirements, the Contract Documents, the Project Specifications, the approved Shop Drawings and Engineering Data, and/or the Roofing Manufacturer’s standard details – of work in progress or completed work – shall not relieve the Contractor of, or reduce, or in any way limit, his responsibility of full performance of the work required of him under the requirements of the Roofing Manufacturer, the Contract Documents, the Project Specifications, the approved Shop Drawings and Engineering Data, and/or the Roofing Manufacturer’s standard details

1.11 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.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Do not expose materials subject to water or solar damage in quantities greater than can be weatherproofed during same day.

E. Phased Construction will not be accepted.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: **Elevate.**

B. Additional Approved Manufacturers: For systems approved as equivalent to the Basis of Design system.
   1. GAF
   2. Soprema
   3. The Garland Company
   4. Johns Manville

C. Substitutions: Per Division 1 by roofing contractor. Manufacturer or distributor to not provide substitution request.

D. Thermoplastic Hybrid roofing shall include but not be limited to:
1. Mechanically Attached Anchor Sheet at insulating concrete deck only: membrane complying with ASTM D 4601, Type II.
2. Base Ply Sheet Modified Membrane: Type I membrane complying with ASTM 6163, Grade S.
3. Cap Sheet Membrane: PVC KEE Fleeceback; Type III membrane complying with ASTM D4434.
4. Stripping Ply Sheet Modified Membrane: Type I membrane complying with ASTM 6163, Grade S.
5. Base Flashing Assembly: PVC KEE Bareback; Type III membrane complying with ASTM D4434.

E. Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

2.2 ROOFING SHEET MATERIALS

A. Mechanically Attached Anchor Sheet for use over Lightweight Insulating Concrete Deck: ASTM D 4601, Type II, 70 mil, heavy duty asphalt coated fiberglass base sheet; suitable for application method specified, and as follows: MB Base

B. Base Ply Sheet Modified Membrane: ASTM D 6163, Grade S, Type I, 120 mil SBS-modified asphalt sheet; suitable for application method specified, and as follows: SBS Glass Torch Base

C. Fleeceback Roofing Cap Sheet: ASTM D 4434, Type III, 115 mil - flexible thermoplastic roofing membrane produced with DuPont™ Elvaloy® KEE, polyester weft-inserted reinforcement and a 5.5 ounce non-woven spunbonded polyester fleece backing suitable for application method specified, and as follows: Elevate 60 mil MIN PVC KEE XR

2.3 BASE FLASHING SHEET MATERIALS

A. Bareback Roofing Sheet: ASTM D 4434, Type III, 115 mil - flexible thermoplastic roofing membrane produced with DuPont™ Elvaloy® KEE, polyester weft-inserted reinforcement suitable for application method specified, and as follows: Elevate 60 mil MIN PVC KEE

2.4 BITUMINOUS ROOFING MATERIALS

A. General: Auxiliary materials provided or recommended by roofing system manufacturer for intended use and compatible with roofing.

B. Asphalt Primer: ASTM D 41/D 41M.

C. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

D. Miscellaneous Materials: Provide those recommended by roofing system manufacturer.

2.5 RELATED MATERIALS

A. Low VOC Bonding Adhesive: As recommended by Thermoplastic Sheet Manufacturer’s printed instructions to develop a bond between the flashing membrane and the substrate to which the membrane is to be attached. Adhesive for bareback membrane is to be LVOC Bonding Adhesive.

B. Fasteners: FM Approved corrosion resistant steel screws of the appropriate size for fasteners for roof membrane and insulation attachment and for sheet metal flashing.

Fasteners for the membrane shall be supplied by the thermoplastic manufacturer and are to be installed as recommended by Thermoplastic sheet manufacturer's printed instructions.

1. Shall be Factory Mutual approved and supplied by the manufacturer for the specific application.
2. Fastener for Brick: Zamac Nailin. Shall be 1/4-inch x 2 inches, stainless steel nail, one piece unit, flat head, as manufactured by Power Fasteners, or approved equal.
3. Fastener for Metal Deck: Shall be a minimum #14 Factory Mutual approved fastener, fluorocarbon coated, with CR-10 coating. A minimum 0.200-inch diameter shank and 0.250-inch diameter thread. To be used with Factory Mutual approved, round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to 30 Kesternich cycles (DIN 50018) shows less than ten percent (15%) red rust which surpasses Factory Mutual Approval Standard 4470 as manufactured by roofing manufacturer.
4. Nails: G-90 galvanized or non-ferrous type, size as required to suite application, minimum 11 gauge with 3/8-inch diameter head.

C. Insulating Concrete Base Sheet Fasteners: Shall be approved by the fastener manufacturer, membrane manufacturer and FM for use with insulating concrete deck as follows:

1. Fastener shall be a single unit, precision formed, of electro zinc coated steel having a 2.7-inch diameter rib reinforced cap and 1.7-inch-long rectangular legs, designed to expand when fully driven into the lightweight insulating concrete. Fasteners for insulating concrete deck shall meet FM Standard 4470 requirements for corrosion resistance. As manufactured by roofing manufacturer.

2.6 ROOF INSULATION OVER STEEL DECKS

A. Polyisocyanurate Roof Insulation: Shall comply with ASTM C1289 Type II Class 2 coated polymer bonded glass fiber mat facer on both sides, with a 20-psi minimum compressive strength. Total thickness shall be as indicated on the drawings and divided in two staggered layers. Size to be 48” x 96” for mechanically attached and 48” x 48” for adhered. Approved product shall be RESISTA as manufactured by Elevate or pre-approved substitute.

B. Cover Board: Moisture resistant, 1/2-inch-thick gypsum roof board, ASTM C 1278; provide 48” by 48” nominal size: “DensDeck Prime” by Georgia Pacific or pre-approved equal.

C. Tapered Insulation: Factory cut 48 inches x 48 inches polyisocyanurate board; slope and thickness to vary as required to achieve a minimum ¼” per foot finished slope unless noted otherwise on the Drawings (cricketed areas between roof drains / scuppers are to achieve a minimum ½” per foot slope); ASTM C1289 Type II Class 2 coated polymer bonded glass fiber mat facer on both sides, with a 20-psi minimum compressive strength. Approved product shall be tapered RESISTA as manufactured by Elevate or pre-approved substitute. Provide 1/2-inch recovery board similar to that specified above over tapered polyisocyanurate board insulation.

D. Tapered Edge Strip: Tapered perlite complying with ASTM C208, Type II manufactured by Blue Ridge.

E. Insulation Adhesive: Bead-Applied Insulation Adhesive: Insulation manufacturers recommended bead-applied, low-rise, one-component, or multicomponent urethane adhesive formulated to attach coverboard and tapered insulation (if required) and second layer of insulation.

2.7 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to

defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Solar Reflectance Index: Not less than 64 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

D. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings from an applicable testing agency.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces and site conditions are ready to receive work.

C. Verify deck is supported and secure.

D. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains or eaves, and suitable for installation of roof system.

E. Verify deck surfaces are dry and free of snow or ice.

F. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood cants and nailers are in place.
1. Verify that wood nailers have been anchored in accordance with SPRI ES-1 requirements.

G. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
1. Take moisture readings for the insulating concrete deck using moisture meter approved by the roofing manufacturer. Do not install roofing system over deck not meeting dryness requirements as determined by the roofing manufacturer.

H. Verify that insulating concrete provides positive drainage meeting requirements of membrane manufacturer prior to beginning roofing operations.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.

B. Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.

C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of the modified bituminous roofing system.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of workday or when rain is forecast.
1. Provide tie-ins at end of each day's work to cover exposed roofing sheets and insulation with a course of roofing cement, with joints and edges sealed. On Thermoplastic cap sheet provide sealant, with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Apply roofing materials as specified by manufacturer's instructions:
1. Keep roofing materials dry before and during application.
2. Do not permit phased construction.
3. Complete application of roofing plies, modified sheet and flashing in a continuous operation.
4. Begin and apply only as much roofing in one day as can be completed that same day.

3.3 RIGID BOARD INSULATION AND COVER BOARD OVER ACOUSTICAL STEEL DECK

A. Fasteners exposed through bottom flutes of acoustical steel deck shall not be allowed.

B. Install insulation and cover board per current ASCE 7 guidelines and as specified herein.

C. Install rigid board insulation over acoustical steel deck with long dimension of initial layer of insulation boards perpendicular to flutes of metal roof deck.

D. Install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6-inches in each direction.

E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water. Stagger all joints and butt tight. Cut neatly around all roofing penetrations and interruptions.

G. Install tapered insulation to conform to slopes indicated in the drawings and the reviewed Shop Drawings.

H. Install cover board over rigid insulation in accordance with manufacturer’s recommendations. Stagger all joints and butt tight. Cut neatly around all roofing penetrations and interruptions.

I. Mechanically fasten first layer of insulation board using membrane manufacturer’s recommended steel screw fasteners and metal plates. Screw fasteners shall extend through top flutes of metal decking **ONLY**, and by a minimum of 1”. Use approved fastening pattern as specifically recommended by the roofing system manufacturer to meet or exceed current ASCE 7 wind uplift guidelines.
1. Spacing of fasteners for insulation board shall meet requirements by roofing manufacturer to support the specified warranty and as required to meet all code and ASCE-7 requirements for the design wind loading.
2. Where allowed by membrane manufacturer, code authorities. and ASCE-7 requirements for spacings, insulation board, cover board, and membrane may be fastened concurrently.

J. Specified second layer of insulation, tapered insulation (if required) and cover board, the top surface of the underlying layer of insulation shall have bead applied low rise foam adhesive applied to it. Do now allow adhesive to skim over prior to setting subsequent board, and subsequent layers of insulation shall be applied using offset joints, so that all individual insulation layers joints are offset a minimum of twelve inches (12") both ways with the preceding layer and immediately walked in place and weighed down per manufacturers requirements. Contractor to utilize water rollers to walk in and even distribute insulation adhesive below prior to being weighed down.

3.4 SBS MODIFIED BITUMINOUS BASE PLY INSTALLATION

A. Install base plies according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
1. Lay out the roll in the course to be followed and unroll 6 feet.
2. Using a roofing torch, heat the surface of the coiled portion until the burn-off backer melts away. At this point, the material is hot enough to lay into the substrate.

Progressively unroll the sheet while heating and insure a proper bond.

3. After the major portion of the roll is bonded, re-roll the first 6 feet and bond it in a similar fashion.
4. Repeat this operation with subsequent rolls with side laps of 4 inches and end laps per manufacturers requirements.
5. Give each lap a finishing touch by passing the torch along the joint and spreading the melted bitumen evenly with a rounded trowel to ensure a smooth, tight seal.

B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
1. Repair voids in laps and lapped seams not completely sealed.

C. Install roofing sheets so side and end laps shed water.

3.5 THERMOPLASTIC MEMBRANE INSTALLATION

A. General: Install in strict accordance with manufacturer's latest published requirements, instructions, specifications, and details and approved shop drawings.

B. Over the properly installed and prepared substrate, apply manufacturers low-rise foam to clean dry surface. The foam shall be applied at a rate according to manufacturer requirements. Allow to rise per manufacturers application guide. No foam is applied to the back of the fleeceback membrane. Do not allow foam to skin over or surface-dry prior to installation of fleece-back membrane.

C. The Fleeceback roof membrane is unrolled immediately into the foam. Adjacent rolls overlap previous rolls by 3 inches. This process is repeated throughout the roof area. Immediately after application into the foam, each roll shall be firmly pressed into place with a broom or water filled, foam covered lawn roller by frequent rolling in two directions.

D. Contractor to utilize water rollers to walk in and even distribute insulation adhesive.

E. Weld cover strips at all seams that do not have a factory selvage edge.

3.6 BASE FLASHING INSTALLATION

A. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply LVOC bonding adhesive to seam area of flashing.

B. Flash penetrations and field-formed inside and outside corners with sheet flashing as recommended by manufacturer.

C. Clean seam areas, overlap seams, and firmly roll flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

D. Test lap edges with probe to verify seam weld continuity. Apply lap sealant, if required by roofing manufacturer, and seal exposed edges of sheet flashing terminations per manufacturer’s requirements.

E. Terminate and seal top sheet flashings and mechanically anchor to substrate through termination bars.

3.7 ROOF DETAILING INSTALLATION

A. Coordinate counter flashing, cap flashings, expansion joints, and similar work with roofing membrane work (as specified in other Sections).

B. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work (as specified in other Sections).

3.8 FIELD QUALITY CONTROL

A. Perform manufacturer’s field inspection and as required at appropriate intervals.

B. Correct defects or irregularities discovered during field inspection.

C. Require attendance of roofing materials manufacturers' representatives at site during installation of the roofing system. A copy of the specification should also be on site at all times.

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, inspect roofing 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. Remove bitumen adhesive drippings from all walls, windows, floors, ladders and finished surfaces.

D. In areas where finished surfaces are soiled by asphalt or any other sources of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning instructions and conform to their instructions.

E. Repair or replace defaced or disfigured finishes caused by work of this Section.

3.10 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction.

3.11 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs, and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor.

D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. Notify the Owner and Architect upon completion of corrections.

G. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

H. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

3.12 ROOFING INSTALLER'S SEPARATE WARRANTY: Reprint and fully execute the following installer's warranty on installation company's letterhead:

ROOFING INSTALLER'S 5-YEAR NO EXCLUSION WARRANTY

WHEREAS <NAME> of <ADDRESS>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

Owner:
Address:
Building Name/Type:
Address:
Area of Work:
Acceptance Date:
Warranty Period:
Expiration Date:

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 of 5-years after the Date of Substantial Completion of the Project.

NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his 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.

This Warranty is made subject to the following terms and conditions:

Coverage specifically included under this Warranty are damages to work and other parts of the building, and to building contents, caused by

Sustaned winds up to 75 MPH and gusts to 115 MPH

Coverag specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

Lightning;
Acts of vandalism;
Fire;
Failure of roofing system structural substrate, including cracking, excessive deflection, deterioration, and decomposition;
Activity on roofing other than normal foot traffic, and maintenance activities.

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 has been paid by Owner or by another responsible party so designated.

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.

The Owner shall notify Roofing Installer on becoming aware, 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. Nothing in this

warranty shall prevent the Owner from making emergency repairs to faulty or damaged roofing areas to prevent further damage to roof, building or contents, and warranty coverage shall not be affected by the performance of such emergency repairs.

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.

IN WITNESS THEREOF, this instrument has been duly executed this <DAY> day of <MONTH>, 20<YEAR>.

Authorized Signature:
Name:
Title:

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fabricated sheet metal items, including:
   1. Flashings and counter flashings not a part of Unit Masonry systems.
   2. Roof fascias and gravel stops.
   3. Gutters and downspouts.
   4. Scuppers.
   5. Metal trim not part of manufactured roof or wall systems.

B. Related Sections:
   1. Section 04 20 00 - Unit Masonry Assemblies: Flashings embedded in masonry.
   2. Section 07 54 05 - Thermoplastic Membrane Roofing - Mechanically Attached: Roof fascias and gravel stops.
   3. Section 07 90 00 - Joint Protection.

1.2 REFERENCES

A. American Society of Civil Engineers:
   1. ASCE-7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:
   1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products.
   4. ASTM B32 - Standard Specification for Solder Metal.
   5. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   6. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Federal Specification Unit:
   1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

E. Single Ply Roofing Institute:
   1. SPRI ES-1 - Wind Design Guide for Edge Systems Used with Low-Slope Roofing Systems.

1.3 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install items of this Section to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the area wind zone pressures in accordance with ASCE-7 requirements.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods,

flashings, terminations, and installation details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

D. Samples: Submit two samples of each exposed metal finish.

E. Product Test Reports: Submit report based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of copings and roof edge flashings with performance requirements.

1.5 QUALIFICATIONS

A. Installer: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Finish Warranty for Prefinished Steel Sheet: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
   1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

A. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M coil coated.
   1. Base Metal: ASTM A653/A653M; Structural Quality; G90 zinc coating, minimum 24 gage thick.
   2. Exposed Finish: Minimum two coat fluoropolymer coating with minimum 70 percent polyvinylidene fluoride resin.
   3. Unexposed Finish: Manufacturer’s standard coating.
   4. Color to be selected by Architect.

B. Stainless Steel: ASTM A240/240M; Type 304, dead soft fully annealed; smooth surface, Number 2D finish; minimum 26 gage thick.

2.2 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers. Match finish of exposed heads with material being fastened.

B. Underlayment: ASTM D226; Type II, No. 30 un-perforated asphalt felt.

C. Protective Backing Paint: FS TT-C-494, Bituminous.

D. Sealant: As specified in Section 07 90 00.

E. Plastic Cement: ASTM D4586, Type I.

F. Solder: ASTM B32; type suitable for application and material being soldered.

2.3 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form nonmoving seams with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams. Form seams and joints in accordance with SMACNA standards.

F. Fabricate corners from one piece with minimum 18 inch long legs; seam and seal prefinished steel, solder stainless steel.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

H. Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate gutters to rectangular profile as indicated on Drawings.

K. Fabricate downspouts to square profile, 4-1/2 x 4-1/2 inch size unless indicated otherwise.

L. Fabricate accessories in profile and size to suit gutters and downspouts:
   1. Anchorage Devices: In accordance with SMACNA requirements.
   2. Gutter Supports: Brackets and straps.
   3. Downspout Supports: Straps.

M. Seal metal joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and nailing strips located.
   1. Verify that wood nailers have been anchored in accordance with SPRI ES-1 requirements.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Paint concealed metal surfaces with protective paint to minimum dry film thickness of 15-mil.

3.3 INSTALLATION

A. Install sheet metal flashing and trim in accordance with SMACNA requirements.

B. Secure flashings in place using concealed fasteners wherever possible. Use exposed fasteners only where not exposed to public view.

C. Install flashings embedded in roofing system in accordance with roofing manufacturer's details and instructions to meet SPRI ES-1 requirements.

D. Install edge flashings in accordance with Section 07 54 05 to meet SPRI ES-1 requirements.

E. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 18 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Secure gutters and downspouts in place.

H. Slope gutters minimum 1/4 inch per foot.

I. Seal metal joints watertight.

3.4 SCHEDULE

A. Gutters with Girth up to 20-Inches: Prefinished steel, 24 gage.

B. Gutters with Girth 20 to 25-inches: Prefinished steel, 22 gage.

C. Downspouts: Prefinished steel, 24-gage.

D. Scuppers: Stainless steel, 24-gage.

E. Gravel Stops and Fasciae: Two-piece snap-on edge flashings by roof membrane manufacturer.

F. Exposed Trim: Prefinished steel, 24-gage.

G. Counterflashings and Receivers: Stainless steel, 24-gage.

H. Roof Expansion Joints: Stainless steel, 24-gage.

I. Equipment Support and Roof Penetration Flashing: Stainless steel, 24-gage.

END OF SECTION

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Roof curbs and equipment supports.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood curbs.
   2. Section 07 54 05 - Thermoplastic Membrane Roofing - Mechanically Attached.
   3. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings.
   4. Section 07 72 33 - Roof Hatches.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

B. National Roofing Contractors Association:
   1. NRCA - The NRCA Roofing and Waterproofing Manual.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Manufacturer's Installation Instructions: Submit instructions for special procedures and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA and NRCA details.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
   1. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes or roof expansion joints.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pre-Finished Galvanized Steel Sheet: ASTM A755/A755M coil coated.
   1. Base Metal: ASTM A653/A653M; Structural Quality; G90 zinc coating, minimum 24-gage thick.
   2. Exposed Finish: Minimum two coat fluoropolymer coating with minimum 70 percent polyvinylidene fluoride resin.
   3. Unexposed Finish: Manufacturer’s standard coating.

B. Sealant: As specified in Section 07 90 00.

C. Roofing Cement: As recommended by roofing membrane manufacturer.

2.2 ROOF CURBS AND EQUIPMENT SUPPORTS

A. Roof Curbs: Provide metal roof curbs and equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or shop drawings of equipment to be supported.

B. Manufacturers:
1. Custom Curb, Inc. www.customcurbinc.com
2. Roof Products, Inc. www.rpicurbs.com
3. ThyCurb www.thybar.com
4. Uni-Curb, Inc.
5. Vent Products Company, Inc. www.ventprod.com

C. Load Requirements: As indicated.

D. Material: Prefinished steel sheet, 24-gage thick, minimum.

E. Factory install wood nailers at tops of curbs and supports.

F. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.

G. Factory insulate curbs with 1-1/2 inch thick glass fiber board insulation.

H. Fabricate units to minimum height of 12 inches above adjacent roof surface, unless otherwise indicated.

I. Sloping Roofs: Fabricate curbs and equipment supports with height tapered to match slope to level tops of units.
1. Where slope of roof exceeds 1:48, fabricate units with water diverter or cricket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify deck, curbs, roof membrane, base flashing, and other items affecting Work of this section are in place and positioned correctly.

3.2 INSTALLATION

A. Conform to SMACNA - Architectural Sheet Metal Manual and NRCA - Waterproofing Manual.

B. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

C. Install roof curbs and equipment supports so that top surface of unit is level.

D. Coordinate installation of sealants and roofing cement with Work of this section to ensure water tightness.

END OF SECTION

SECTION 07 72 33 - ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Roof hatches.
   2. Roof hatch safety railing.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood curbs.
   2. Section 07 54 05 – Thermoplastic Membrane Roofing.
   3. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings.
   4. Section 07 71 00 - Roof Specialties.

1.2 REFERENCES

A. Underwriters Laboratories Inc.:
   1. UL - Building Materials Directory.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.

C. Manufacturer's Installation Instructions: Indicate special installation criteria and interface with adjacent components.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA and NRCA details.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

A. Manufacturers:
   1. Babcock-Davis www.babcockdavis.com
   2. Bilco Company www.bilco.com
   3. Custom Curb, Inc. www.customcurb.com
   4. Milcor Inc. www.milcorinc.com
   5. Nystrom, Inc. www.nystrom.com
   6. O'Keeffe's Inc. www.okeeffes.com
   7. Roof Products, Inc. www.rpicurbs.com
   8. ThyCurb www.thybar.com
   9. Uni-Curb, Inc.
   10. Vent Products Company, Inc. www.ventprod.com
   11. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Manufacturer’s standard aluminum, with nominal 12-inch high integral curb, double-wall insulated type.

C. Size: 2’-6” x 3’-0” single-leaf, for ladder access.

D. Loads: Minimum 40-lbf/sq.ft. external live load and 30-lbf/sq.ft. uplift.

E. Integral Aluminum Curb: Minimum 11 gage mill finished aluminum; nominal 1-inch rigid glass fiber insulation; integral cap flashing to receive roof flashings; extended flange for mounting.

F. Flush Aluminum Cover: Minimum 11-gage mill finish aluminum; nominal 1-inch glass fiber or insulation; minimum 18 gage aluminum interior liner; continuous neoprene or vinyl gasket to provide weatherproof seal.

G. Hardware: Manufacturer's standard Cadmium plated finish:
1. Compression spring operator;
2. Steel manual pull handle for interior and exterior operation;
3. Steel hold open arm with vinyl covered grip handle for easy release,
4. Padlock hasp.
5. Hinges: Manufacturer's recommended type for specific type of roof hatch.

H. Safety Railings: Manufacturer's integral hatch railing and gate system curb-mounted on 3 sides of the hatch.
1. Swinging gate automatically latches in the closed position. Non-roof-penetrating attachment.
2. Fabricated from fiberglass-reinforced polymer pipe and finished in safety yellow factory-applied paint. Mounting brackets Hot dip galvanized steel.
3. 25-year manufacturer's warranty.
4. Basis of Design: *Bil-Guard* as manufactured by Bilco.

2.2 ACCESSORIES

A. Anchorage Devices: Type recommended by manufacturer.

B. Counterflashings: Same metal type and finish as roof hatch frame.

C. Protective Coating: Bituminous, FS TT-C-494.

D. Sealant: As specified in Section 07 90 00.

2.3 FABRICATION

A. Fabricate components free of visual distortion and free of defects. Weld corners and joints.

B. Provide for condensation occurring within components and within assembly to drain to exterior above roofing.

C. Fit components for weather tight assembly.

D. Sloped Roofs: Fabricate roof hatch curbs tapered to maintain hatch top level.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings and substrate conditions are ready to receive Work of this section.

3.2 PREPARATION

A. Apply protective coating on aluminum surfaces of roof hatches to be in contact with cementitious materials or dissimilar metals.

3.3 INSTALLATION

A. Install curb assembly, fastening securely to roof decking. Flash curb assembly into roof system.

B. Place roof hatch and secure to curb assembly. Install integral setting sealant and counterflashing as required.

C. Final installation to be watertight assembly.

D. Coordinate with installation of roofing system and related flashings for weather tight installation.

E. Apply bituminous paint on surfaces of units in contact with cementitious materials or dissimilar metals.

F. Adjust hinges for smooth operation.

G. Install safety railing in accordance with manufacturer’s printed instructions.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Wash down exposed surfaces; wipe surfaces clean.

C. Remove excess sealant.

END OF SECTION

SECTION 07 81 00 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Spray-on cementitious fireproofing for interior exposed and concealed structural steel where indicated.
2. Intumescent coating fireproofing for exposed interior and exterior structural steel where indicated.

B. Related Sections:
1. Section 05 12 00 - Structural Steel.
2. Section 05 21 00 - Steel Joist and Girders.
3. Section 07 84 00 - Firestopping.

1.2 REFERENCES

A. ASTM International:
1. ASTM C847 - Standard Specification for Metal Lath.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
4. ASTM E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
5. ASTM E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
6. ASTM E760 - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
7. ASTM E761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
8. ASTM E859 - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
9. ASTM E937 - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
10. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 PERFORMANCE REQUIREMENTS

A. Applied (Sprayed-On) Fireproofing Systems: Provide fire rated assembly ratings as indicated on Drawings.

B. Air Erosion: Maximum 0.025 gram/sq. ft allowable weight loss of fireproofing when tested in accordance with ASTM E859.

C. Corrosion: No contribution to corrosion of steel test panels when tested in accordance with ASTM E937.

D. Mold Resistance: Material to show resistance to fungi growth when tested in accordance with ASTM C665 requirements for fungi resistance of insulation or ASTM G21.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Submit data for each type of fireproofing specified, indicating product characteristics, performance criteria, and limitations of use.
2. Submit data for each type of finish paint to be used over intumescent coating. Provide documentation of intumescent coating manufacturer's approval of proposed paint type.

C. Samples:
1. Provide 12" x 12" finish samples of each type and selected color of finish paint for steel to be coated with intumescent fireproofing.
2. Reference mock-up requirements under Part 3 Installation below.

D. Product Data: Submit data for each type of fireproofing specified, indicating product characteristics, performance criteria, and limitations of use.

E. Test Reports: Indicate the following:
1. Compressive Strength: ASTM E761.
2. Dry Density: ASTM E605.
3. Bond Strength of Fireproofing: ASTM E736.
4. Bond Impact: ASTM E760.
5. Fire test reports of fireproofing application to substrate materials, including primers, similar to Project conditions, conducted in conformance to ASTM E84 and ASTM E119.
6. Air Erosion: ASTM E859.
7. Corrosion: ASTM E937.
8. Mold Resistance: ASTM C665 or ASTM G21.

F. Intumescent Paint Fireproofing Systems Test Reports: Indicate the following:
1. Fire test reports of fireproofing application to substrate materials, including primers, similar to Project conditions, conducted in conformance to ASTM E84 and ASTM E119.

G. Manufacturer's Installation Instructions: Submit information including special procedures, and conditions requiring special attention.

H. Manufacturer's Certificate: Certify applied fireproofing products meet or exceed specified requirements.
1. Certify applied fireproofing products contain no asbestos or other finely-divided particulate matter that can be released as airborne health hazard during or after application.

I. Manufacturer's Field Reports: Indicate compliance with manufacturer's installation instructions and Contract Documents.

1.5 QUALITY ASSURANCE

A. Fireproofing Assembly: Rating as indicated on Drawings.
1. Tested Rating: Determined in accordance with ASTM E119.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section, with minimum three years' experience.

B. Applicator: Company specializing in performing Work of this section, with minimum three years' experience and approved by manufacturer.

1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain minimum ambient and substrate temperature of 40 degrees F during and for minimum 24 hours after application of fireproofing, unless otherwise recommended by manufacturer.

C. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

1.9 SEQUENCING

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

B. Sequence Work in conjunction with placement of masonry anchors and ties, partition track, and mechanical component hangers.

C. Provide temporary enclosure as required to confine spraying operations and protect the environment.

D. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.

E. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.

F. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.

G. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.

H. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.

I. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

J. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
   2. Not covered under the warranty are failures due to damage by occupants and

Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

C. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCEALED SPRAY-ON CEMENTITIOUS FIREPROOFING

A. Manufacturers:
1. Carboline Co., Pyrocrete www.carboline.com
2. W. R. Grace & Co., Monokote Type MK-6/HY www.grace.com
3. Isolatek International Corp., Cafco 300 www.cafco.com
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description:
1. Low Density Cementitious Type: Factory mixed, cementitious material blended for uniform texture with vermiculite or lightweight synthetic aggregate, and conforming to the following requirements:
a. Type: As recommended by manufacturer for concealed interior applications.
b. Compressive Strength: ASTM E761, minimum 5.21 psi.
c. Dry Density: ASTM E605, minimum average density of 15 lb/cu ft.
d. Bond Strength: ASTM E736, 150 psf when set and dry.
e. Bond Impact: ASTM E760, no cracking, flaking or delamination.

2.2 EXPOSED SPRAY-ON CEMENTITIOUS FIREPROOFING

A. Manufacturers:
1. Carboline Co., Pyrocrete 241 www.carboline.com
2. W. R. Grace & Co., Monokote Type Z106 www.grace.com
3. Isolatek International Corp., Cafco 400 www.cafco.com
4. Pyrok, Inc., Pyrok-MD www.pyrokinc.com
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description:
1. Medium Density Cementitious Type: Factory mixed, portland cement blended for uniform texture with mineral aggregates or mineral fibers and additives, without chlorides, approved for exterior use and conforming to the following requirements:
a. Type: As recommended by manufacturer for exposed interior applications, and for concealed exterior use.
b. Compressive Strength: ASTM E761, minimum 51 psi.
c. Dry Density: ASTM E605, minimum density of 22 lb/cu ft.
d. Bond Strength: ASTM E736, 434 psf when set and dry.
e. Bond Impact: ASTM E760, no cracking, flaking or delamination.

2.3 INTUMESCENT PAINT FIREPROOFING

A. Manufacturers:
1. AD Fire Protection Systems, www.adfire.com.
2. Albi Manufacturing, www.albi.com
3. Isolatek International Corp., www.cafco.com
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis-of-Design:
1. Interior: Isolatek International Corp., Cafco SprayFilm-WB 3 Basecoat.
2. Exterior: Isolatek International Corp., Cafco SprayFilm-WB 4 Basecoat and Topseal.

C. Thin-Film Fire-Resistive Intumescent Mastic Coating: Factory-mixed formulation.
1. Water-Based Formulation: Approved by manufacturer and authorities having jurisdiction for interior or exterior use as indicated.Retain first option below for colored appearance or

protective topcoat.
2. Color and Gloss: Color and Gloss: As selected by Architect in coordination with manufacturer.
3. Provide manufacturer's topcoat where required by manufacturer.

2.4 ACCESSORIES

A. Primer, Adhesive, Bonding Agent, and Topseal as recommended by fireproofing manufacturer.

B. Metal Lath: Expanded metal lath where required for cementitious fireproofing; 3.4 lb/sq ft, galvanized finish; conform to ASTM C847.

C. Water: Clean, potable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive fireproofing.

C. Verify clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

D. Verify ducts, piping, equipment, or other items interfering with application of fireproofing have not been installed.

E. Verify voids and cracks in substrate have been filled. Verify projections have been removed where fireproofing will be exposed to view as finish material.

F. Verify roof traffic has ceased and roof mounted equipment is in place.

G. Ensure that all steel members and sections scheduled to receive fireproofing have been properly prepared by the fabricator to receive the specified fireproofing application.

3.2 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials affecting bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing.

D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.

E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

F. Close off and seal duct work in areas where fireproofing is being applied.

3.3 APPLICATION - SPRAY-ON CEMENTITIOUS FIREPROOFING

A. Install metal lath over steel members as required by fire rated assembly Design Numbers.

B. Apply primer or adhesive as required by fireproofing manufacturer for conditions encountered.

C. Apply fireproofing in sufficient thickness to achieve required fire ratings, with as many passes as necessary to cover with monolithic blanket of uniform density and texture.

D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.

E. Patch damaged work.

3.4 APPLICATION - INTUMESCENT PAINT FIREPROOFING

A. Apply primer and fireproofing in accordance with manufacturer's instruction.

B. Cut back primer 3 inches for bolted connections and 12 inches for welded connections.

C. Apply fireproofing in sufficient thickness to achieve indicated fire rating with as many passes as necessary. Provide multiple thinner coats of intumescent coating in order to build up required thicknesses in lieu of heavier coats that encourage surface deformations.

D. Interior and exterior intumescent paint fireproofing shall be finish painted with decorative topcoat. Utilize fireproofing manufacturer’s recommended paint type for the particular installation, in color(s) selected.

1. Provide manufacturer’s approved acrylic paint for interior applications, and manufacturer’s approved aliphatic urethane paint for exterior applications.

2. Acceptable final finish is slight “orange peel” without runs, drips, sags, or other surface deformations whether in the finish paint or the underlying intumescent coating.

E. Mock-ups

1. Provide on-site mock-ups of both interior and exterior finished steel for Architect’s approval. Approved mock-ups will be used as the minimum acceptable standard of finish.

2. Mock-ups will have full required thickness of intumescent paint prior to application of finish paint.

3. As determined by the Architect, steel finishes not meeting the minimum acceptable standard of finish shall be removed and recoated and finished.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

C. Independent Testing Agency To:
1. Inspect fireproofing substrates prior to application of fireproofing for surface temperature and surface preparation in accordance with manufacturer's instructions.
2. Inspect installed fireproofing after application and curing for integrity, prior to its concealment.
3. Test frequency and type in accordance with applicable code and authorities having jurisdiction.
4. Inspect for the following:
   a. Installed Thicknesses and Density: ASTM E605.
   b. Bond Strengths: ASTM E736.
5. Re-inspect installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.6 MANUFACTURER'S FIELD SERVICES

A. Section 01 40 00 - Quality Requirements: Manufacturers’ field services.

B. Observe site conditions, conditions of surfaces and installation, quality of workmanship, and initiate instructions when necessary.

C. Manufacturer's Field Reports: Document above observations; include environmental conditions under which fireproofing materials were installed.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess material, overspray, droppings, and debris.

C. Remove fireproofing from materials and surfaces not required to be fireproofed.

D. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

END OF SECTION

SECTION 07 84 00 - FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Penetrations through fire-resistance rated wall, floor, and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
2. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
3. Sealant joints in fire-resistance rated construction.

B. Related Sections:
1. Section 04 20 00 – Unit Masonry Assemblies: Mortar used for firestopping.
2. Section 09 21 16 - Gypsum Board Assemblies: Gypsum board for fireproofing.

1.2 REFERENCES

A. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance and limitation criteria.

C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
      a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
   1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
   2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. A qualified inspection agency shall check installed firestopping systems for compliance with requirements.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

B. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.
   1. Manufacturers:

a. FireMaster Bulk and FireMaster Mastic, Thermal Ceramics www.thermalceramics.com

C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
1. Manufacturers:
a. Fyre-Shield, Tremco, Inc. www.tremcosealants.com
b. Flame-Safe FS900/FST900 Series, International Protective Coatings Corp. www.flamesafe.com

D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
1. Manufacturers:
a. SpecSeal Triple S Intumescent Sealant, Specified Technologies Inc. www.stifirestop.com
b. SpecSeal LCI Intumescent Sealant, Specified Technologies Inc.
c. Metacaulk 950, The RectorSeal Corporation. www.rectorseal.com/firestopping/fp2.htm
d. Fire Barrier CP 25WB + Caulk, 3M Fire Protection Products. www.3m.com/firestop
e. Tremstop IA, Tremco, Inc.

E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
1. Manufacturers:
a. SpecSeal Series SSP Firestop Putty and Putty Pads, Specified Technologies Inc. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
b. Fire Barrier Moldable Putty +, 3M Fire Protection Products.

F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
1. Manufacturers:
a. SpecSeal Series SSW Wrap Strips, Specified Technologies Inc. FS 601 Intumescent Wrap, Hilti Construction Chemicals, Inc. www.us.hilti.com
b. Fire Barrier FS-195 + Wrap/Strip, 3M Fire Protection Products.
c. Tremstop WS, Tremco, Inc.

G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.
1. Manufacturers:
a. USG Firecode Compound, United States Gypsum Co. www.usg.com

H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
1. Manufacturers:
a. SpecSeal Series SSM Mortar, Specified Technologies Inc.
b. KBS-Mortar Seal, International Protective Coatings Corp.
c. Tremstop M, Tremco, Inc.

I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
1. Manufacturers:
a. KBS Sealbags, International Protective Coatings Corp.
b. Tremstop PS, Tremco, Inc.

J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
1. Manufacturers:

a. Fire Barrier 2001 Silicone ATV Foam, 3M Fire Protection Products.
b. Pensil 200 Foam, General Electric Co. www.ge.com/silicones

K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Manufacturers:
a. PENSIL Series PEN300 Silicone Sealant, Specified Technologies Inc.
b. 2000 Silicone Sealant, 3M Fire Protection Products.
c. FS 601 Firestop Sealant, Hilti Construction Chemicals, Inc.
d. Metacaulk 835 +, The RectorSeal Corporation. www.rectorseal.com
e. Metacaulk Pipe Collars, The RectorSeal Corporation.
f. Fyre-Sil, Tremco Inc.
g. Fyre-Sil S/L, Tremco Inc.

L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.2 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
1. Sealant Colors: As selected.

B. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
a. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.
2. Manufacturers:
a. Dow Corning 790, Dow Corning Corp. www.dowcorning.com
b. Dow Corning 795, Dow Corning Corp.
c. Silpruf SCS 2000, General Electric Co.
d. Ultraglaze SSG 4000, General Electric Co.
e. 864, Pecora Corp. www.pecora.com
f. Fyre-Sil, Tremco, Inc.)

C. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
a. 40 percent movement in extension and 25 percent in compression for a total of

65 percent movement.
b. 50 percent movement in both extension and compression for a total of 100 percent movement.

2. Manufacturers:
a. Vulkem 922, Mameco International Inc.
b. Dynflex, Pecora Corp.
c. Dynatred, Pecora Corp.
d. Dynatrol II, Pecora Corp.
e. Sikaflex 2cn NS, Sika Corp. www.sikausa.com
f. Sonolastic NP 2, Sonneborn Building Products www.chemrex.com
g. Dymeric, Tremco Inc.

D. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.
1. Manufacturers:
a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
b. Isoflex 881, Harry S. Peterson Co., Inc.
c. Vulkem 921, Mameco International Inc.
d. Sikaflex 15LM, Sika Corp.

2.3 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

3.3 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

F. Place intumescent coating in sufficient coats to achieve rating required.

G. Remove dam material after firestopping material has cured.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspecting agency shall examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

C. Inspecting agency will report observations promptly and in writing to Contractor and Architect.

D. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

E. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 90 00 - JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sealants and joint backing, pre-compressed foam sealers, and accessories for building expansion joints, control joints, and joints between dissimilar materials where not a part of work specified under other sections.

B. Sections Related to Work Under This Section:
1. Section 03 30 00 – Cast-In-Place Concrete: Sealant at expansion and control joints in interior and exterior walls, and in exposed interior concrete floors.
2. Section 04 20 00 – Unit Masonry Assemblies: Sealant at expansion and control joints.
3. Section 08 11 13 – Standard steel Doors and Frames: Perimeter sealant at interior and exterior door frames.
4. Section 08 41 13 – Aluminum Framed Entrances and Storefronts: Perimeter joints between storefront assemblies and adjacent materials.
5. Section 08 44 13 – Glazed Aluminum Curtain Walls: Perimeter joints between curtain wall assemblies and adjacent materials.
6. Section 08 91 00 - Louvers: Perimeter joints between louvers and adjacent materials.
7. Section 09 21 16 - Gypsum Board Assemblies: Joints between drywall assemblies and adjacent materials.
8. Section 09 24 00 – Portland Cement Plastering: Control and perimeter joint sealing.

C. Sealant Work Specified in Other Sections:
1. Section 06 20 23 – Finish Carpentry and Millwork: Sealant between millwork assemblies and adjacent materials.
2. Section 07 13 00 – Sheet Waterproofing: Sealant at shower pan membrane and below-grade waterproofing systems.
3. Section 07 54 05 – Thermoplastic Membrane Roofing System: Sealant as part of membrane roofing system.
4. Section 07 61 03 – Manufactured Sheet Metal Roofin: Sealant as part of metal roofing system.
5. Section 07 62 00 – Sheet Metal Flashing and Trim: Sealant as part of metal flashing systems.
6. Section 07 84 00 - Firestopping: Sealant as part of firestopping assemblies.
7. Section 08 80 00 - Glazing: Glazing sealants.
8. Section 09 21 16 - Gypsum Board Assemblies: Acoustic sealant at drywall partitions.
9. Section 09 30 00 – Tiling: Sealant as part of tiling systems, including expansion and control joints.
10. Section 12 32 16 – Plastic Laminate-Clad Casework: Sealant between casework assemblies and adjacent materials.
11. Division 22 Sections: Sealants as part of plumbing systems and fixture installations.
12. Division 32 Sections: Sealants at paving and sidewalk joints.

1.2 REFERENCES

A. ASTM International:
1. ASTM C834 - Standard Specification for Latex Sealants.
2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
3. ASTM C1193 - Standard Guide for Use of Joint Sealants.
4. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
5. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
6. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years' experience.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

PART 2 - PRODUCTS

2.1 JOINT SEALERS

A. Manufacturers:
1. Dow Corning Corp. www.dowcorning.com.
2. GE Silicones www.gesilicones.com.
3. Pecora Corp. www.pecora.com.
4. Sika Corp. www.sikaconstruction.com.
5. Tremco Sealants & Waterproofing www.tremco.com.
6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 EXTERIOR SEALANTS:

A. General Purpose Exterior (Nontraffic) Sealant: Polyurethane; ASTM C920, Grade NS, Class 50, Uses M, G, A, and O; multi- component. Reference Division 32 sections for sealants related to paving and sidewalks.
1. Type: Dymeric 240FC manufactured by Tremco.
2. Color: Standard colors matching finished surfaces.
3. Applications: Use for:
   a. Control, expansion, and soft joints in masonry.
   b. Joints between concrete and other materials.
   c. Joints between metal frames and other materials.
   d. Exposed joints in metal copings, trim, and flashings.
   e. Other exterior nontraffic joints for which no other sealant is indicated.

B. Exterior Foam Expansion Joint Sealer: Precompressed foam sealer; Polyurethane with water-repellent, +/- 25 percent movement capability.
   1. Color: Face color as selected.
   2. Size: As required to provide watertight and airtight seal when installed.
   3. Applications: Use for exterior wall expansion joints.
   4. Manufacturers:
      a. Colorseal; Emseal Corp. www.emseal.com.
      b. Polytite R or Polytite Standard; Dayton Superior www.daytonsuperior.com.
      c. Illmod 600; Tremco www.tremco.com.
      d. Willseal 600; Willseal USA LLP www.willsealusa.com.
      e. Substitutions: Section 01 60 00 - Product Requirements.

C. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, non-drying, non-skinning, non-curing.
   1. Type: Butyl Sealant manufactured by Tremco.
   2. Applications: Use for concealed sealant bead in sheet metal work and concealed sealant bead in siding overlaps.

2.3 INTERIOR SEALANTS:

A. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
   1. Type: Tremflex 834 manufactured by Tremco.
   2. Color: Standard colors matching finished surfaces.
   3. Applications: Use for interior wall and ceiling control joints, joints between door and window frames and wall surfaces, and other interior joints for which no other type of sealant is indicated.
   4. For interior control joints in brick, unpainted concrete masonry, cast stone, or stone, use General Purpose Exterior Sealant.

B. General Purpose Interior Traffic Bearing Sealant: Polyurethane; ASTM C920, Type S, Grade P, Class 50, Use T; single- component, semi self-leveling.
   1. Type: Vulkem 45 SSL manufactured by Tremco.
   2. Color: Standard colors matching finished surfaces.
   3. Applications: Use for interior pedestrian traffic bearing joints

C. Interior Foam Acoustic Gap Filler: Precompressed mass-loaded pre-formed polyurethane foam sealer with minimum 25 percent movement capability.
   1. Basis of Design: *Quiet Joint* as manufactured by Emseal or approved equivalent by specified manufacturer.
   2. Color: Color of both finished faces to match anodized glazing mullion.
   3. Size: As indicated.
   4. Applications: Provide visual and acoustic protection in open gap between glazing mullion and adjacent interior construction.
   5. Manufacturers:
      a. Colorseal; Emseal Corp. www.emseal.com.
      b. Polytite R or Polytite Standard; Dayton Superior www.daytonsuperior.com.
      c. Illmod 600; Tremco www.tremco.com.
      d. Willseal 600; Willseal USA LLP www.willsealusa.com.
      e. Substitutions: Section 01 60 00 - Product Requirements.
   6. After installation use putty knife to smooth any wrinkling at faces and edges.

2.4 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
   1. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056, sponge or expanded rubber; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve the following:
   1. Width/depth ratio of 2: 1.
   2. Neck dimension no greater than 1/3 of joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave.

G. Pre-compressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

END OF SECTION

SECTION 07 95 00 - PREMANUFACTURED EXPANSION JOINT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following types of metal expansion joint covers:
   1. Interior pedestrian traffic joints.
   2. Interior wall and ceiling joints.
   3. Interior soffit joints.

B. Related Sections:
   1. Section 03 30 00 - Cast-In-Place Concrete: Block-outs and cast-in anchorage and frames for expansion joint systems in concrete floors, parking decks, and walls.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim: Sheet metal roof and wall joint systems.
   3. Section 07 90 00 - Joint Protection; Elastomeric sealants and preformed compressed-foam sealants without metal frames.

1.2 DEFINITIONS

A. Expansion Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and applied sealants.

B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.

D. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.

E. Revise below if it is impossible either to indicate nominal joint widths based on a prediction when the joint system will be installed or, if none is indicated, to establish them based on maximum and minimum joint widths.

F. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when expansion joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide factory-fabricated expansion joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.
   1. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
   2. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
   3. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
   4. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
   5. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
   6. Seismic Joints: Remain in place on exposure to seismic activity (movement).
   7. Joints in Surfaces with Architectural Finishes: Serve as finished expansion joint closures.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.

B. Shop Drawings: For each joint system specified, provide the following:
   1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.

C. Samples for Verification: Full-size units 6 inches (150 mm) long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.

D. Product Test Reports: From a qualified testing agency indicating expansion joint systems comply with requirements, based on comprehensive testing of current products.

E. Research/Evaluation Reports: Evidence of expansion joint system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain expansion joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.

B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per ASTM E 119 and UL 2079, including hose-stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: The design for each expansion joint system specified in Part 2 "Expansion Joint Systems" Article below is based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the other manufacturers listed.

2.2 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), alloy 6061-T6 for sheet and plate.
   1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.

D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 EXPANSION JOINT SYSTEMS

A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
3. Public Arena Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces and complying with ADA guidelines for public areas.
4. Nominal Joint Widths: As indicated.
5. Type of Movement Capability: Expansion and contraction.
6. Preformed Seal Material: Manufacturer's standard.
a. Seal Color: Selected by Architect.
7. Exposed Frame Material: Aluminum.
8. Fire-Resistance Ratings: For joint systems at rated conditions, provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

B. Basis-of-Design Products: The design for each expansion joint system specified below is based on the products named. Subject to compliance with requirements, provide either the named products or comparable products by one of the following manufacturers:
1. Architectural Art Manufacturing, Inc. www.archart.com
2. Balco Metalines, www.balcousa.com
3. Construction Specialties, Inc. www.c-sgroup.com
4. InPro Corp. www.inprocorp.com.
5. MM Systems, Inc. www.mmsystemscorp.com

C. Expansion Joint System: Metal frames and preformed seals for the following interior conditions:
1. Floor-to-Floor Joints, Basis-of-Design Product: Construction Specialties, Inc.; “ALS” Series.
2. Floor-to-Wall Joints, Basis-of-Design Product: Construction Specialties, Inc.; “ALSW” Series.
3. Wall-to-Wall Joints, Basis-of-Design Product: Construction Specialties, Inc.; “AFW” Series.
4. Wall-to-Ceiling Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCSC” Series
5. Ceiling-to-Ceiling Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCS” Series.
6. Wall-to-Soffit Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCSC” Series.
7. Soffit-to-Soffit Joints, Basis-of-Design Product: Construction Specialties, Inc.; “FCS” Series.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Mill Finish: AA-M10 (Mechanical Finish: as fabricated; no other applied finish unless buffing

is required to remove scratches, welding, or grinding produced in fabrication process.
1. Provide at floor conditions unless otherwise indicated.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
1. Provide at wall, ceiling, and soffit conditions unless otherwise indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to expansion joint system manufacturer's written instructions.

B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing expansion joint assemblies and materials, unless more stringent requirements are indicated.

B. Coordinate installation of expansion joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
4. Locate wall, ceiling, and soffit covers in continuous contact with adjacent surfaces.
5. Securely attach in place with required accessories.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

D. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

E. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.
1. For straight sections, provide preformed seals in continuous lengths.
2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
4. Seal transitions according to manufacturer's written instructions.

F. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard

lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.

G. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION

SECTION 08 11 13 - STANDARD STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Steel frames for doors and windows.
   2. Steel doors.

B. Related Sections:
   1. Section 08 14 16 - Flush Wood Doors: For wood veneer or plastic laminate clad doors set in steel frames.
   2. Section 08 71 00 - Door Hardware: For finish hardware requirements of steel doors and frames.
   3. Section 08 80 00 – Glazing: For glazing panels set in steel frames and glass lights set in steel door faces.
   4. Section 09 90 00 - Painting and Coating: Field painting of shop-primed steel doors and frames.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

B. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E413 - Standard Classification for Rating Sound Insulation.

C. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

D. Steel Door Institute:
   1. SDI 108 - Recommended Selection and Usage Guide for Standard Steel Doors.

E. Underwriters Laboratories Inc.:
   1. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate door elevations, frame elevations, internal reinforcement, anchor types and spacing, door closure method, and cut-outs for hardware, glazing, and louvers.

C. Product Data: Submit door configurations, frame configurations, location of cut-outs for hardware reinforcement.

D. Manufacturer's Installation Instructions: Submit special installation instructions.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

F. Oversize Construction Certificates: For door assemblies required to be fire rated and exceeding size limitations of labeled assemblies.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI A250.8.

B. Fire Rated Door and Frame Construction: Conform to NFPA 252.

C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated on Drawings.

D. Attach label from agency approved by authority having jurisdiction to identify each fire rated door and frame.

E. Surface Burning Characteristics:
   1. Foam Insulation in Fire Rated Doors: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
   2. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum years' experience and approved by manufacturer.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept doors and frames on site in manufacturer's packaging. Inspect for damage.

C. Break seal on site to permit ventilation.

1.8 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with door opening construction, door frame, and door hardware installation.

C. Coordinate installation to accommodate door hardware electric wire connections.

PART 2 - PRODUCTS

2.1 STANDARD STEEL DOORS AND FRAMES

A. Manufacturers:
   1. Amweld Building Products www.amweld.com
   2. Ceco Door www.cecodoor.com
   3. Curries www.curries.com
   4. Deansteel Manufacturing, Inc. www.deansteel.com
   5. Kewanee Corporation www.kewaneecorp.com
   6. Mesker Door, Inc. www.meskerdoor.com
   7. Pearland Industries
   8. Pioneer Industries Inc. www.pioneerindustries.com
   9. Republic Doors and Frames. www.republicdoor.com
   10. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description - Doors: To suit ANSI A250.8 and the following:

1. Exterior Doors (Insulated): Level 3 - Extra heavy Duty, Model 2, seamless design, 16 gage face sheets, 1-3/4 inches thick, galvanized A60.
2. Interior Doors (Non-Rated): Level 3 - Extra heavy Duty, Model 2, seamless design, 16 gage face sheets, 1-3/4 inches thick, ungalvanized.
3. Interior Doors (Fire Rated): Level 3 - Extra heavy Duty, Model 2, seamless design, 16 gage face sheets, 1-3/4 inches thick, unglvanized.

C. Product Description - Frames: Fully welded steel frames, to suit ANSI A250.8 and the following:
1. Exterior: Level 3 - Extra heavy Duty, 16-gage thick material, galvanized A60.
a. Furnish 14 gage thick material for frames over 48 inches wide.
2. Interior: Level 3 - Extra heavy Duty, 16-gage material, ungalvanized.
a. Furnish 14-gage material for frames over 48 inches wide.

2.2 DOOR COMPONENTS

A. Face: Steel sheet in accordance with ANSI A250.

B. End Closure: Channel, 0.04 inches thick, flush.

C. Core: Manufacturer’s standard core consisting of one of the following:
1. Resin-impregnated cardboard honeycomb.
2. Polyurethane.
3. Polystyrene foam.
4. Mineral fiberboard.

D. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors and frames fabricated as thermal-insulating assemblies and tested according to ASTM C236 or ASTM C976 on fully operable door assemblies.
1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F or better.

E. Sound-Rated (Acoustical) Assemblies: Where shown or scheduled, provide doors and frames fabricated as sound-reducing assemblies, tested according to ASTM E1408, and classified according to ASTM E 413.
1. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or better.

2.3 FRAME COMPONENTS: Frames: Steel sheet in accordance with ANSI A250.

2.4 ACCESSORIES

A. Removable Stops: Rolled steel, channel shape, butted corners; prepared for countersink style screws.

B. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

C. Primer: ANSI A250.10, manufacturer’s standard rust inhibitive type.

D. Silencers: Specified in Section 08 71 00; resilient rubber fitted into drilled hole.

2.5 FABRICATION

A. Doors:
1. Fabricate doors with hardware reinforcement welded in place.
2. Glazing Stops: Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass.
3. Attach fire rated label to each fire rated door.

B. Frames:
1. Fabricate frames as welded unit.

2. Mullions for Double Doors: Removable, specified in Hardware Section.
3. Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.
4. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
5. For frames installed in masonry walls, and which will receive stop-applied seals or weatherstripping, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of the seals and weatherproofing.
6. Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors.
7. Attach fire rated label to each fire rated frame.
8. Glazing Stops: Provide non-removable stops on the outside and removable, screw-applied stops on the room side of doors and frames for glass.

2.6 SHOP FINISHING: Baked-on primer, ready for finish field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify opening sizes and tolerances are acceptable.

3.2 FRAME INSTALLATION

A. Install frames in accordance with ANSI A250.8.

B. Coordinate with masonry and gypsum board wall construction for anchor placement.

C. Provide at least three wall anchors per jamb. For openings 90 inches or more in height, install four wall anchors per jamb.

D. Coordinate installation of glass and glazing specified in Section 08 80 00.

E. Coordinate installation of frames with doors and with hardware specified in Section 08 71 00.

F. Coordinate installation of frames with installation of doors specified in Section 08 14 16.

3.3 DOOR INSTALLATION

A. Install doors in accordance with ANSI A250.8.

B. Install door louvers and glazing frames plumb and level.

C. Coordinate installation of glass and glazing specified in Section 08 80 00.

D. Coordinate installation of doors with frames and with hardware specified in Section 08 71 00.

E. Touch-up damaged shop finishes.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

C. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

D. Clearances for Fire-Rated Doors: In accordance with NFPA 80.

3.5 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for adjusting.

B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Flush wood doors with plastic laminate faces.

B. Related Sections:
   1. Section 08 11 13 - Standard Steel Doors and Frames: Steel frames.
   2. Section 08 71 00 - Door Hardware.
   3. Section 08 80 00 - Glazing.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E413 - Standard Classification for Rating Sound Insulation.

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

D. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

E. National Fire Protection Association:
   1. NFPA 80 - Standard for Fire Doors, Fire Windows.
   2. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

F. Underwriters Laboratories Inc.:
   1. UL - Building Materials Directory.
   2. UL 10B - Fire Tests of Door Assemblies.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, identify cutouts for glazing and louvers.

C. Product Data: Submit information on door core materials and construction.

D. Samples:
   1. Submit two samples of door construction, 12 x 12 inch in size, cut from top corner of door.
   2. Submit two samples of plastic laminate illustrating laminate pattern and color.
   3. Submit two samples of lite opening frames, 6 inches long, for each material, type, and finish required.

E. Manufacturer's Installation Instructions: Submit special installation instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWI Quality Standard Section 1300, Custom Grade.

B. Finish doors in accordance with AWI Quality Standard Section 1500.

C. Fire Rated Door Construction: Conform to NFPA 252.

D. Attach label from agency approved by authority having jurisdiction to identify each fire rated

door.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package deliver and store doors in accordance with AWI Section 1300.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.
1. Break seal on site to permit ventilation.

1.7 PROJECT CONDITIONS

A. Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.8 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.9 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with door opening construction, door frame and door hardware installation.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Include coverage for delamination, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Furnish manufacturer's "Life of Installation" warranty for interior doors.

PART 2 - PRODUCTS

2.1 FLUSH WOOD DOORS

A. Manufacturers:
1. Algoma Hardwoods Inc. www.algomahardwoods.com
2. Eggers Industries www.eggersind.com
3. GRAHAM Manufacturing Corp. www.grahamdoors.com
4. IPIK Door Company www.ipikdoor.com
5. Marshfield Door Systems Inc. www.marshfielddoors.com
6. VT Industries www.vtindustries.com
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Solid core flush wood doors; 1-3/4 inches thick, five-ply construction, plastic laminate facing material; fire and acoustic rated as indicated on Drawings.

2.2 COMPONENTS

A. Plastic Laminate Doors: Solid core, 5-ply construction, AWI Section 1300, core as follows:

1. Non-Rated: Structural composite lumber core.
2. 20- and 45-Minute Rating: Structural composite lumber core.
3. 60-Minute Rating: Agri-fiber core.
4. 90-Minute Rating: Mineral core.

B. Special Construction for Mineral Core Fire Doors:
1. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:
   a. 5-inch top-rail blocking.
   b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
   c. 5-inch midrail blocking, in doors indicated to have armor plates.
   d. 5-inch midrail blocking, in doors indicated to have exit devices.
2. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance, painted to match plastic laminate facing at plastic laminate doors.
3. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for applications indicated without formed-steel edges and astragals.

C. Acoustical Doors: AWI Section 1300, Type SR- Sound Retardant (Acoustical).

D. Plastic Laminate Facing (Interior): NEMA LD-3, General Purpose Type, 0.050 inch thick, type as indicated on Drawings.

E. Cross Banding Behind Laminate Finish: 1 ply; manufacturer’s standard construction.

F. Facing Adhesive: Type II - water resistant.

2.3 ACCESSORIES

A. Glazing Stops - Wood Veneer Doors:
1. Rolled steel, factory primed frames for fire rated doors.

B. Glazing Stops - Plastic Laminate-Clad Doors:
1. Rolled steel, factory primed frames.

2.4 FABRICATION

A. Fabricate doors in accordance with AWI Quality Standards requirements.

B. Sound Rating for Acoustical Door: ASTM E413, minimum STC-45.

C. Furnish lock blocks at lock edge and top of door for hardware reinforcement.

D. Vertical Exposed Edge of Stiles: Hardwood painted to match laminate for plastic laminate doors.

E. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.

F. Factory fit doors for frame opening dimensions identified on shop drawings.

G. Provide edge clearances in accordance with AWI 1300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

A. Install doors in accordance with AWI Quality Standards requirements.

B. Trim non-rated door width by cutting equally on both jamb edges.

C. Trim door height by cutting bottom edges to maximum of 3/4 inch.
   1. Trim fire door height at bottom edge only, in accordance with fire rating requirements.

D. Machine cut doors for hardware installation.

E. Coordinate installation of doors with installation of frames specified in Section 08 11 13 and hardware specified in Section 08 71 00.

F. Coordinate installation of glass and glazing specified in Section 08 80 00.

3.3 INSTALLATION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Conform to AWI requirements for fit and clearance tolerances.

C. Conform to AWI Section 1300 requirements for maximum diagonal distortion.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust door for smooth and balanced door movement.

C. Adjust closer for full closure.

END OF SECTION

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire resistive rated and non-rated access doors and panels with frames.
   1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.
   2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.

1.2 REFERENCES

A. ASTM International: ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Intertek Testing Services (Warnock Hersey Listed): WH - Certification Listings.

C. National Fire Protection Association: NFPA 80 - Standard for Fire Doors, Fire Windows.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate exact position of access door units.

C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.

D. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.4 QUALITY ASSURANCE

A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

B. Fire Rated Access Doors: Rating as indicated on Drawings.
   1. Tested Rating: Determined in accordance with ASTM E119.

C. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

1.5 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND PANELS

A. Manufacturers:
   1. J. L. Industries.
   2. Karp Associates, Inc.
   3. Milcor LTD, Partnership.
   4. Nystrom Products Co.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Flush Framed Access Doors: Frames and nominal 1 inch wide exposed flanges of 16 gage steel and door panels of 14 gage steel.

C. Gypsum Board Access Doors: Frames and nominal 1 inch wide flanges of 16 gage steel and door panels of 14 gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 21 16.

D. Plaster Access Doors: Frames and nominal 1 inch wide flanges of 16 gage steel and door panels of 14 gage steel. Design flanges to be concealed by plaster specified in Section 09 24 00.

E. Fire Rated Access Doors: Frames and nominal 1 inch wide exposed flanges of minimum 16 gage steel and door panels of 20 gage steel. Provide self-closing and latching doors with keyed lock to match cylinders specified in Section 08 71 00.

F. Gypsum Board Fire Rated Access Doors: 16 gage steel frames with minimum 22 gage galvanized steel drywall bead flanges and door panels of 20 gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 21 16. Provide self- closing and latching doors with keyed lock to match cylinders specified in Section 08 71 00.

2.2 FABRICATION

A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.

B. Wall and Ceiling Access Door and Panel Hardware:
1. Hinge: Standard continuous or concealed spring pin type, 175 degree steel hinges.
2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock.

C. Size Variations: Obtain acceptance of manufacturer’s standard size units which vary slightly from sizes shown or scheduled.

2.3 SHOP FINISHING

A. Base Metal Protection: Galvanized, hot dipped wiped coat finish.

B. Finish: One coat baked enamel, color as selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for access doors and panels are correctly sized and located.

3.2 INSTALLATION

A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.
1. Set concealed frame type units flush with adjacent finished surfaces.

B. Position unit to provide convenient access to concealed work requiring access.

C. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

END OF SECTION

SECTION 08 32 13 - SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sliding glass doors at interior display cases.
2. Provide 2-panel and/or 3-panel configurations as indicated.

B. Related Sections:

1. Section 07 90 00 - Joint Protection: Perimeter sealant.
2. Section 08 71 00 - Door Hardware: Removable cylinder keyed to Owner’s building system for lockset on sliding doors.
3. Section 08 80 00 - Glazing.

1.2 DEFINITIONS

A. Grade “C”: Commercial grade.

B. Performance grade number, included as part of the AAMA code designating sliding aluminum-framed glass door products, is the actual design pressure in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide sliding aluminum-framed glass doors capable of complying with performance requirements indicated based on testing manufacturer's doors representative of those specified and of the test size indicated below:

1. Minimum size required by AAMA/NWWDA 101/I.S.2.

B. AAMA Performance Requirements: Provide sliding aluminum-framed glass doors of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

1. Performance Class: C.
2. Performance Grade: Minimum 20.

C. Deglazing: No disengagement of glazing surround members of operable panels when tested according to ASTM E 987 at 70 lbf (312 N) on vertical rails and 50 lbf (223 N) on other rails.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of sliding aluminum-framed glass door indicated, including the following:

1. Construction details and fabrication methods.
2. Profiles and dimensions of individual components.
3. Data on hardware, accessories, and finishes.
4. Recommendations for maintaining and cleaning exposed surfaces.

C. Shop Drawings: For each type of sliding aluminum-framed glass door indicated. Include information not fully detailed in manufacturer's standard Product Data and the following:

1. Fabrication, layout, and installation details, including anchors.
2. Typical door elevations.
3. Hardware.
4. Accessories.

D. Samples for Verification: Architect reserves the right to require additional Samples that show fabrication techniques, workmanship, and design of sliding glass door, hardware, and accessories.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed sliding aluminum-framed glass door installations similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain sliding aluminum-framed glass doors and aluminum-framed entrances and storefronts through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, dimensional requirements, and aesthetic effects of sliding aluminum-framed glass doors and are based on the specific doors indicated. Other manufacturers' products with equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 1 Section "Substitutions."

D. Sliding Aluminum-Framed Glass Door Standard: Comply with provisions of AAMA/NWWDA 101/I.S.2 for standards of performance, materials, components, and fabrication, unless more stringent requirements are indicated.

E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

F. Glazing Publications: Comply with written recommendations of glass manufacturers and GANA's "Glazing Manual," unless more stringent requirements are indicated.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify sliding aluminum-framed glass door openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating sliding aluminum-framed glass doors without field measurements.
   2. Coordination: Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. General Warranty: Special warranty 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.

C. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures, including excessive deflection.
   2. Faulty operation of movable panels and hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal exposure.
   4. Warranty Period: Three years from date of Substantial Completion.
   5. Warranty Period for Glass: Five years from date of Substantial Completion.
   6. Warranty Period for Metal Finishes: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Arch Aluminum & Glass Co., Inc., www.arch.amarlite.com
2. EFCO Corporation, www.efcocorp.com
3. Kawneer, www.kawneer.com
4. United States Aluminum, www.usalum.com
5. Vistawall Architectural Products, www.vistawall.com
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis-of-Design: Kawneer, 1010 Sliding Mall Front.

2.2 GLAZING

A. Glazing System: 1/4 inch thick clear tempered glass in manufacturer's standard glazing system.

2.3 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid bronze; extruded, cast, or wrought aluminum; solid white metal with special coating finish; or nonmagnetic stainless steel.

B. Roller Assemblies: Provide movable panels with rollers and roller assemblies that comply with AAMA 906.3.

C. Threshold and Sill Cap/Track: Provide extruded-aluminum threshold and track of thickness, dimensions, and profile indicated; designed to comply with performance requirements indicated; with manufacturer's standard finish.
1. Multi-Track for 2-panel or 3-panel doors with opening configuration as indicated in the drawings.
a. Interior Floor Track: Recessed type.
b. Interior Floor Track: Low profile, with stainless steel cap.

D. Door Pulls: Provide manufacturer's standard flush face pull on each movable panel.

E. Locks: Provide hook bolt lock accepting removable cylinder keyed to Owner’s master keying requirements (*Sargent Large Format*):
1. Removable cylinder provided under the Hardware Section.
2. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

2.4 FABRICATION

A. General: Fabricate sliding aluminum-framed glass doors in sizes indicated that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.

C. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/NWWDA 101/I.S.2.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: Non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Examine openings before installation. Verify that opening is correct and sill plate is level. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing doors, hardware, accessories, and other components.

B. Set doors level, plumb, and true to line, without warp or rack of frames and panels. Provide proper support and anchor securely in place.
   1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B to AAMA/NWWDA 101/I.S.2.

3.3 ADJUSTING

A. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean aluminum surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging protective coatings and finishes. Remove excess glazing and sealants, dirt, and other substances.

C. Clean glass of factory-glazed doors immediately after installing sliding aluminum-framed glass doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels from glass surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.

3.5 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sliding aluminum-framed glass doors from damage or deterioration until time of Substantial Completion.

END OF SECTION

SECTION 08 33 13 - OVERHEAD COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Stainless steel overhead coiling counter doors.
   2. Manual operation.

B. Related Sections:
   1. Section 08 33 23 - Overhead Coiling Doors.
   2. Section 08 71 00 - Door Hardware.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 SYSTEM DESCRIPTION

A. Manual Operation: Manual push up unit with overhead counter balance device, requiring 25 lb nominal force to operate.

1.4 DESIGN REQUIREMENTS

A. Operation: Design door assembly to operate for not less than 10,000 cycles.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

C. Product Data: Submit general construction, component connections and details.

D. Samples: Submit two door slats of each material, 12 inch long, illustrating shape, color and finish texture.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, and adjustment and alignment procedures.

1.6 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing work of this section with minimum three years’ experience and approved by manufacturer.

PART 2 - PRODUCTS

2.1 OVERHEAD COUNTER DOORS

A. Manufacturers:
1. The Cookson Company www.cooksondoor.com/index
2. Cornell Iron Works Inc. www.cornelliron.com
3. McKeon Rolling Steel Door Company, Inc. www.mckeondoor.com
4. Overhead Door Corporation. www.overheaddoor.com
5. Raynor Garage Doors. www.raynor.com/index.cfm
6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Curtain: Conform to following:
1. Stainless Steel Slats: Interlocking, minimum 24 gage of stainless steel conforming to ASTM A666 Type 304 rollable temper.
a. Type: Single thickness flat slat.
2. Nominal Slat Size: 2 inches wide by required length.
3. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
4. Curtain Bottom: Tube-shape, providing reinforcement and positive contact with counter in closed position; of material to match curtain.

B. Guides: Material to match curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel. Provide removable stops on guides to prevent overtravel of curtain.

C. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension.

D. Hood Enclosure: Square shape, minimum 24 gage stainless steel; internally reinforced to maintain rigidity and shape.

E. Hardware: Specified in Section 08 71 00 and as follows:
1. Handle: Inside center mounted, adjustable keeper, spring activated latch bar with feature to keep in locked or retracted position; interior handle.

2.3 SHOP FINISHING

A. Stainless Steel: NAAMM No. 4 satin directional polished finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

A. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

B. Securely and rigidly brace components suspended from structure.

C. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

D. Coordinate installation of sealants and backing materials at frame perimeter as specified in

Section 07 90 00.

E. Install perimeter trim and closures.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maintain dimensional tolerances and alignment with adjacent Work.

C. Maximum Variation from Plumb: 1/16 inch.

D. Maximum Variation from Level: 1/16 inch.

E. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust door, hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean door and components.

C. Remove labels and visible markings.

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Insulated exterior overhead coiling doors.
   2. Non-insulated interior overhead coiling doors.
   3. Electric operation with manual override.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: Support framing.
   2. Section 08 71 00 - Hardware: Removable cylinder keyed to Owner’s building system for coiling door control stations.
   3. Section 09 90 00 - Painting and Coating: Field painted finish of factory-primed guides and hood enclosure.
   4. Division 26 and 28 Sections:
      a. Power and final connections.
      b. Coordination with emergency generator circuit and fire/smoke alarm activation.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

B. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
   3. NEMA MG 1 - Motors and Generators.

1.3 SYSTEM DESCRIPTION

A. Electric Operation: Electric motor operated unit with manual override in case of power failure.

1.4 DESIGN REQUIREMENTS

A. Wind Loads: Design exterior door assembly to withstand wind/suction loads indicated on Drawings, with maximum deflection of 1/120, and without damage to door shutter or assembly components.

B. Operation: Design door assembly, including operator, to operate for not less than 10,000 cycles.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details, including wiring diagrams for electric operators.

C. Product Data: Submit general construction, component connections and details, wiring diagram and electrical equipment.

D. Samples: Submit two door slats, 12 inches long, illustrating shape, color and finish texture.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, and

adjustment and alignment procedures.

1.6 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.7 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL or another testing firm acceptable to authority having jurisdiction.

B. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum years' experience and approved by manufacturer.

PART 2 - PRODUCTS

2.1 OVERHEAD COILING DOORS

A. Manufacturers:
1. The Cookson Company www.cooksondoor.com/index
2. Cornell Iron Works Inc. www.cornelliron.com
3. McKeon Rolling Steel Door Company, Inc. www.mckeondoor.com
4. Overhead Door Corporation. www.overheaddoor.com
5. Raynor Garage Doors. www.raynor.com/index.cfm
6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Curtain for Exterior Doors: Conforming to the following:
1. Steel Slats: Interlocking, minimum 24 gage of ASTM A653/A653M steel, with galvanized coating designation G90 in accordance with ASTM A924/A924M.
a. Type: Sandwich slat construction with insulated core.
2. Nominal Slat Size: 2 inches wide x required length.
3. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
4. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets or high-strength nylon, as required to comply with wind load.
5. Curtain Bottom: Fitted with minimum 1-1/2 x 1-1/2 x 1/8 inch angles to provide reinforcement and positive contact with floor in closed position; galvanized.
a. Provide motor-operated doors with combination bottom astragal and sensor edge.
6. Insulation: Manufacturer's standard rigid cellular polystyrene or polyurethane foam-type thermal insulation complying with maximum flame spread and smoke developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.

B. Curtain for Interior Doors: Fire rated in accordance with requirements indicated on Drawings:
   1. Steel Slats: Interlocking, minimum 24 gage of ASTM A653/A653M steel.
      a. Type: Single thickness S-configuration slat.
      b. Rated opening as scheduled.
   2. Nominal Slat Size: 2 inches wide by required length.
   3. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   4. Curtain Bottom: Fitted with minimum 1-1/2 x 1-1/2 x 1/8 inch angles to provide reinforcement and positive contact with floor in closed position.
   5. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior door. Bumper color to be black.
   6. Provide motor-operated doors with combination bottom astragal and sensor edge.

C. Guides: Minimum 3/16 inch thick; galvanized steel conforming to ASTM A653/A653M, minimum galvanized coating designation G90 in accordance with ASTM A924/A924M.
   1. Furnish continuous angles of profile to retain door in place; mounting brackets of same metal. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension.

D. Hood Enclosure: Round shape, minimum 24 gage galvanized steel; internally reinforced to maintain rigidity and shape.

E. Mounting Tube Frame: Provide manufacturer's standard mounting tube frame designed to support grille; factory fabricated from structural-steel tubes; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

F. Electric Operator:
   1. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   2. Comply with NFPA 70.
   3. Disconnect Device for Manual Operation: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
   4. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
   5. Provide 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.
   6. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head hoist-type door operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain-hoist and floor level disconnect.
   7. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps or more than 1 fps, without exceeding nameplate ratings or considering service factor.
      a. Type: Polyphase, medium-induction type.
      b. Service Factor: According to NEMA MG 1, unless otherwise indicated.
      c. Coordinate wiring requirements and electric characteristics of motors with building electrical system.

d. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.

8. Remote-Control Station: Provide keyed control station with 3-position controls labeled "Open," "Close," and "Stop."
   a. Provide one control station on each side of door where doors are installed across corridors or other traffic areas.
   b. Provide switch body accepting removable cylinder keyed to Owner's master keying requirements (*Sargent Large Format*). Removable cylinder provided under the Hardware Section.
9. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
10. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
    a. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    b. Provide electrically actuated automatic bottom bar.
    c. Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.
11. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
12. Emergency Operation: Where scheduled, doors shall self-open (powered by emergency generator) when activated by the fire/smoke alarm system or loss of primary power. When the alarm is cleared and power is restored, Doors shall automatically reset for normal operation. Provide adjustable time delay of up to 10 seconds from signal or power failure until start of door opening.

2.3 SHOP FINISHING

A. Curtain Slats: Steel, with factory powder coat finish, color as selected by Architect from manufacturer's full range.

B. Steel Guides and Hood Enclosure: Prime for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

A. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

B. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

C. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

D. Coordinate installation of electrical service. Complete wiring from disconnect to unit components and from fire alarm system to door operator.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 00.

F. Install perimeter trim and closures.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maintain dimensional tolerances and alignment with adjacent Work.

C. Maximum Variation from Plumb: 1/16 inch.

D. Maximum Variation from Level: 1/16 inch.

E. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust door, hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean door and components.

C. Remove labels and visible markings.

END OF SECTION

SECTION 08 34 73 - SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel sound-control doors, frames, seals, and certain hardware for music area doors as scheduled.

B. Related Sections:
   1. Section 08 71 00 – Door Hardware: For required hardware not provided under this section.
   2. Section 09 90 00 – Painting and Staining: For field-applied paint finishes for steel doors and frames.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated. Include sound ratings, construction details, material descriptions, core descriptions, and finishes.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of sound-control seals, door bottoms, and thresholds.
   3. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   5. Locations of reinforcement and preparations for hardware.
   6. Details of each different wall opening condition.
   7. Details of anchorages, joints, field splices, and connections.
   8. Details of accessories.
   9. Details of moldings, removable stops, and glazing.
   10. Details of conduit and preparations for power, signal, and control systems.

D. Samples:
   1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
   2. Retain both subparagraphs below if fabrication Samples are required.
   3. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; glazing; and hinge and other applied hardware reinforcement.
   4. Frames: Include profile, corner joint, floor and wall anchors, and seals. Include separate section showing fixed sound panels if applicable.

E. Schedule: Provide a schedule of sound-control door assemblies prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule.

F. Product Certificates: For each type of sound-control door assembly, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of sound-control door assembly.

H. Warranty: Samples of special warranty.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound-control door assemblies to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, hinges (when integral for sound control), thresholds, and other items essential for sound control, from single source from single manufacturer.

B. Sound Rating: Provide sound-control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
   1. STC Rating: **Minimum STC-50** as determined by ASTM E 413 when tested in an operable condition according to ASTM E 90 and ASTM E 1408.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in the section with minimum three years' experience.

B. Installer: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Acoustical Testing Agency: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished wood doors.

C. Shipping Spreaders: Deliver welded frames with two removable spreader bars across bottom of frames, tack welded or mechanically attached to jambs and mullions.

D. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch high, wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
   1. If wrappers on doors become wet, remove cartons immediately. Provide a minimum of 1/4 inch space between each stacked door to permit air circulation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of anchorages for sound-control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet sound rating requirements.
      b. Faulty operation of sound seals.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
   2. Warranty Period for Steel Doors: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STEEL SOUND-CONTROL DOOR ASSEMBLIES

A. Manufacturers:
   1. Krieger Specialty Products Company, www.kriegerproducts.com
   2. Overly Door Company, www.overly.com
   3. Substitutions: Section 01 60 00 - Product Requirements.

B. Description: Provide flush-design sound-control doors, 1-3/4 inches thick, of seamless construction; with manufacturer's standard sound-retardant core as required to provide STC ratings indicated. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Fabricate according to ANSI/NAAMM-HMMA 865.
   1. Interior Doors: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.048 inch nominal thickness, or thicker as required to achieve STC rating indicated.
   2. Loose Stops for Glazed Lites in Doors: Same material as face sheets.
   3. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than 6 inches o.c.
   4. Hardware Reinforcement: Same material as face sheets.

C. Materials:
   1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
   2. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control requirements.

D. Finishes:
   1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
      a. 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; compatible with substrate and field-applied coatings despite prolonged exposure.
   2. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
      a. Color and Gloss: As indicated.

2.2 SOUND-CONTROL FRAMES

A. Description: Fabricate sound-control door frames with corners mitered, reinforced, and continuously welded full depth and width of frame. Fabricate according to ANSI/NAAMM-HMMA 865.
   1. Weld frames according to NAAMM-HMMA 820.
   2. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, 0.075 inch nominal thickness, or thicker as required to provide STC rating indicated.
   3. Sound-Control Panel Stops: Formed integral with frames, a minimum of 5/8 inch high, unless otherwise indicated.
   4. Hardware Reinforcement: Fabricate according to ANSI/NAAMM-HMMA 865 of same material as face sheets.

5. Head Reinforcement: Reinforce frames with metallic-coated steel channel or angle stiffener, 0.108 inch nominal thickness, welded to head.
6. Jamb Anchors:
    a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.064 inch nominal thickness metallic-coated steel with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.156 inch thick.
    b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.048 inch nominal thickness uncoated steel unless otherwise indicated.
    c. Pos-tinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8 inch diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
7. Floor Anchors: Not less than 0.079-inch nominal thickness metallic-coated steel, and as follows:
    a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

B. Materials:
1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
3. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M or ASTM F 2329.
4. Powder-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 sound-control door frames of type indicated.
5. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

C. Finishes:
1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
    a. 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; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with ANSI/SDI A250.3 for performance and acceptance criteria.
    a. Color and Gloss: As indicated.

2.3 SOUND-CONTROL HARDWARE

A. Description: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottoms, cam-lift hinges, and thresholds, as required by testing to achieve STC rating indicated.
1. Compression Seals: One-piece units; consisting of closed-cell sponge neoprene seal held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
2. Magnetic Seals: One-piece units; consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer; with retainer cover of same material as door frame; attached to door frame with concealed screws.
3. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
    a. Mounting: Mortised or semi-mortised into bottom of door as required by testing to achieve STC rating indicated.

b. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch when door is fully open; with hardened pin; fabricated from stainless steel.

B. Other Hardware: Comply with requirements in Division 08 Section "Door Hardware".

2.4 SOUND-CONTROL ACCESSORIES

A. Glazing: Comply with requirements in Division 08 Section "Glazing."

B. Grout: Comply with ASTM C 476, with a slump of not more than 4 inches as measured according to ASTM C 143/C 143M.

C. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

A. Sound-Control Steel Door Fabrication: Sound-control doors 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.
1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; welds shall be ground, filled, and dressed to make them invisible and to provide a smooth, flush surface.
2. Glazed Lites: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated. Provide fixed stops and moldings welded on secure side of door.
3. Hardware Preparation: Factory prepare sound-control doors to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in "Door Hardware".
a. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
b. Locate door hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
4. Tolerances: Fabricate doors to tolerances indicated in ANSI/NAAMM-HMMA 865.

B. Sound-Control Frame Fabrication: Fabricate sound-control frames 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. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. 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 in height.
2) Three anchors per jamb from 60 to 90 inches in height.
3) Four anchors per jamb from 90 to 96 inches in height.
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 in height.

2) Four anchors per jamb from 60 to 90 inches in height.
3) Five anchors per jamb from 90 to 96 inches in height.
4) Two anchors per head for frames more than 42 inches wide and mounted in metal stud partitions.

c. Post-installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

5. Head Reinforcement: For frames more than 48 inches wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
6. Hardware Preparation: Factory prepare sound-control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in "Door Hardware."
   a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
   b. Locate hardware as indicated, or if not indicated, according to NAAMM-HMMA 831, "Recommended Hardware Locations for Custom Hollow Metal Doors and Frames."
7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings in frames to be grouted.
8. Tolerances: Fabricate frames to tolerances indicated in ANSI/NAAMM-HMMA 865.

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 sound-control door assemblies.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound-control door frame connections before frame installation.

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 and with installation spreaders in place, adjust and securely brace sound-control door frames to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Frames: Install sound-control door frames in sizes and profiles indicated.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    a. Install sound-control frames with removable glazing stops located on secure side of opening.
    b. Remove temporary braces only after frames or bucks have been properly set and secured.
    c. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    d. Apply corrosion-resistant coatings coating to backs of frames to be filled with mortar or grout.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors, if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary.
1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
    a. Jambs: 1/8 inch.
    b. Head with Butt Hinges: 1/8 inch.
    c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch.
    d. Sill: Manufacturer's standard.
    e. Between Edges of Pairs of Doors: 1/8 inch.

D. Sound-Control Seals: Where seals have been prefit and preinstalled in the factory and subsequently removed for shipping, reinstall seals and adjust according to manufacturer's written instructions.

E. Cam-Lift Hinges: Install hinges according to manufacturer's written instructions.

F. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with sound-control door assembly manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust seals, door bottoms, and other sound-control hardware items right before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
   1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Clean grout off sound-control door frames immediately after installation.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

E. Metallic-Coated Surfaces: Clean abraded areas of doors and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Standard and impact-resistant aluminum-framed storefronts, exterior and interior.
2. Aluminum entrance doors, exterior and interior.
3. Bullet resistant storefront frames.
4. Horizontal sun control devices.

B. Related Sections:
1. Section 07 90 00 - Joint Protection.
2. Section 08 71 00 - Door Hardware.
3. Section 08 44 13 - Glazed Aluminum Curtain Walls.
4. Section 08 80 00 – Typical Interior Glazing.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 501 - Methods of Test for Exterior Walls.
2. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
4. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
5. AAMA MCWM-1 - Metal Curtain Wall Manual.
6. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.

B. ASTM International:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
6. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

C. SSPC: The Society for Protective Coatings:
1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

D. TDI: Texas Department of Insurance.
1. TDI Engineering Services Program for evaluation of impact-resistant glazing assemblies.

1.3 SYSTEM DESCRIPTION

A. Aluminum-framed storefront system includes: tubular aluminum sections; aluminum and glass entrances; shop fabricated, factory finished, with glass and glazing specified in Section 08 80 00 and installed by this Section; related flashings, anchorage and attachment devices.
1. System to be re-glazable from interior.

B. System Assembly: Site assembled.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building

corners.

1. To design pressure indicated on Drawings, as tested in accordance with ASTM E330.

B. Deflection: Limit mullion deflection to 1/175 for spans under 13’-6” and 1/240 plus 1/4 inch for spans over 13’-6”, with full recovery of glazing materials.

C. Internally reinforce aluminum storefront framing to properly support specified sun control devices.

D. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

E. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with AAMA 501.

F. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with glass.

G. Water Leakage: None, when measured in accordance with AAMA 501 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

H. Thermal Transmittance of Assembly (Excluding Entrances): Maximum U Value of 0.69 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503.

I. Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

J. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface.

E. Design Data: Indicate framing member structural and physical characteristics and dimensional limitations.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA SFM-1 and AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Systems specified under this section and Section 08 44 13 Glazed Aluminum Curtain Walls shall be provided by the same manufacturer.

C. Sun control devices mounted to aluminum storefront framing shall be manufactured by framing manufacturer or specifically approved in writing by framing manufacturer for use with the storefront system and shall not limit the storefront system warranty.

1.7 QUALIFICATIONS

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years' experience.

1.8 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual #10.

C. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install sealants or glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section 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 caused by thermal movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components to function properly.
   2. Warranty Period: Two years from date of Substantial Completion.

C. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ALUMINUM-FRAMED STOREFRONTS

A. Manufacturers:
   1. Arcadia Texas, www.arcadianc.com
   2. Arch Aluminum & Glass Co., Inc. www.arch.amarlite.com
   3. Columbia Commercial Building Products, www.ccbpwin.com
   4. EFCO Corporation www.efcocorp.com
   5. Kawneer www.kawneer.com
   6. Tubelite Inc., www.tubeliteinc.com

7. United States Aluminum. www.usalum.com
8. Vistawall Architectural Products. www.vistawall.com/
9. YKK AP America Inc., www.ykkap.com.
10. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis-of Design:
1. Exterior Systems: Provide installed system with label meeting requirements of TDI Evaluation ID CWSF-32.
   a. IR 501 T/IR SINGLE Isolock™ Thermal Break center-glazed impact-resistant exterior storefront framing as manufactured by Kawneer or approved equivalent by specified manufacturer.
   b. Outside glazed with an internal silicone seal.
   c. Thermally broken with 1/4" of high density polyurethane; center glazed to accommodate 1-5/16” thick insulated glazing units.
   d. Furnish closed backs at heads and jambs of exterior frames.
   e. Mullions: Profile of extruded aluminum, 5-inches deep x 2-1/2 to 2-3/4” sightline.
   f. Entrance Doors: Series *350 Medium Sile* as manufactured by Kawneer or approved equivalent by specified manufacturer. Nominal 12-inch wide bottom rail to meet ADA requirements.

2. Typical Interior Systems:
   a. *Trifab VG 450 Framing* as manufactured by Kawneer or approved equivalent by specified manufacturer.
   b. Use for standard interior glazing not scheduled for curtain wall framing.
   c. Flush glazing stops; center glazed to accommodate 1/4 inch thick standard glazing.
   d. Interior Storefront Doors: 1-3/4” thick, nominal 5-inch wide top rail and vertical stiles, nominal 12-inch wide bottom rai to meet ADA requirements; beveled glazing stops.

2.2 INTERIOR BALLISTIC-RESISTANT SYSTEMS:

A. Ballistic Level: Pass **UL 752 Level 3**.

B. Obtain Ballistic-Resistant storefront and storefront doors from a single source.

C. Manufacturers (subject to meeting requirements of drawings):
1. United States Bullet Proofing, Inc.; www.USBP.com
2. Total Security Solutions; www.tssbulletproof.com
3. Armortex; www.armortex.com
4. Ambico; www.ambico.com
5. Substitutions: Section 01 60 00 – Product Requirements

D. Interior Ballistic Rated Storefront: *USAW 400* as manufactured by U.S. Bullet Proofing or approved equivalent by specified manufacturer.

E. Flush glazing stops; center glazed to accommodate Ballistic Resistant glazing.

F. Interior Ballistic Resistant Storefront Doors: *USAD 1000* manufactured by U.S. Bullet Proofing or approved equivalent by specified manufacturer. 2-3/4” thick, nominal 5-5/16”-inch wide top rail and vertical stiles, nominal 12-inch wide bottom rai to meet ADA requirements; beveled glazing stops.
1. Finish: Standard clear anodized finish.

2.3 COMPONENTS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.

C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections, galvanized.

E. Glass: Specified in Section 08 80 00 and 08 88 56.

F. Glazing Materials: Storefront manufacturer's standard types to suit application and to achieve weather, moisture, and air infiltration requirements.

G. Flashings: Minimum 0.032 inch thick aluminum to match mullion sections where exposed.

H. Hardware: In accordance with Section 08 71 00 and as follows:
1. Weather Stripping: Manufacturer's standard replaceable components.
a. AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

I. Sealant and Backing Materials:
1. Sealant Used Within System (Not Used for Glazing): Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
2. Perimeter Sealant: Specified in Section 07 90 00.

J. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum brackets and reinforcements. Provide non-staining, nonferrous shims for aligning system components.

K. Fasteners: Manufacturer's standard stainless steel, compatible with adjacent materials.

L. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

M. Horizontal Sun Control Devices:

1. System: Curtain wall manufacturer's single blade aluminum sun control devices mounted on curtain wall framing.

2. Design Requirements: Design and size components to withstand design loads indicated on Drawings without damage or permanent set.

a. Blade deflection shall not exceed L/120 of span length.

b. Test horizontal sunshade configurations to meet a minimum load of 65 psf with a factor of safety of 1.5 times the design load.

c. Stresses resulting from thermal expansion/contraction and designed wind loading shall not cause permanent deformation of or disengagement from the glazed system.

d. Provide internal mullion reinforcing as required for mounting of sun control blades to mullions.

3. Basis of Design: *Versoleil*™ *SunShade – Single Blade System for Curtain Wall* as manufactured by Kawneer or approved equivalent by specified curtain wall manufacturer:
a. Blade Size: 14-inches deep x width(s) indicated.
b. Orientation: Horizontal.
c. Finish: Clear anodized to match curtain wall framing.

2.4 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.

B. Fabricate sill pans with sealed end dams at jambs and changes in sill height.

C. Fabricate frames for glazing from inside.

D. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

E. Prepare components to receive anchor devices. Fabricate anchors.

F. Arrange fasteners and attachments to conceal from view.

G. Prepare components with internal reinforcement for door hardware.
   1. At exterior door frames, provide weatherstripping at fixed stops.
   2. At interior door frames, provide weatherstripping or silencers at stops to prevent door-to-frame contact.

H. Reinforce framing members for imposed loads.

2.5 SHOP FINISHING

A. Clear Anodized Aluminum Surfaces: AAMA 611, AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.

B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

C. Apply bituminous paint to concealed aluminum surfaces in contact with cementitious materials or dissimilar metals.

D. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

E. Sun Control Devices:
   1. Louvers and Fascias: Clear anodized to match storefront framing.
   2. Outriggers: Factory-painted fluoropolymer or powder coat to match louvers and fascias.

F. Extent of Finish:
   1. Apply factory coating to surfaces exposed at completed assemblies.
   2. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION

A. Install wall system and sun control devices in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent Work.

E. Install sill pans. Turn up ends and edges; seal to adjacent Work to form water tight dam.

F. Coordinate attachment and seal of perimeter air and vapor retarder materials.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install integral flashings and integral joint sealers.

I. Set thresholds in sealant and secure.

J. Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

K. Coordinate installation of glass with Section 08 80 00; separate glass from metal surfaces.

L. Coordinate installation of perimeter sealants with Section 07 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust operating hardware and sash for smooth operation.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

D. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect finished Work from damage.

END OF SECTION

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Aluminum-framed curtain wall system for both exterior and interior glazing.
   2. Horizontal sun control devices.

B. Related Sections:
   1. Section 07 90 00 - Joint Protection.
   2. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
   3. Section 08 80 00 – Typical Interior Glazing.
   4. Section 08 88 56 – Ballistic and Impact-Resistant Glazing.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 501 - Methods of Test for Exterior Walls.
   2. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   3. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
   4. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
   5. AAMA MCWM-1 - Metal Curtain Wall Manual.
   6. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.

B. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   6. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

C. SSPC: The Society for Protective Coatings:
   1. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic).

D. TDI: Texas Department of Insurance.
   1. TDI Engineering Services Program for evaluation of impact-resistant glazing assemblies.

1.3 SYSTEM DESCRIPTION

A. Glazed aluminum curtain wall system includes: tubular aluminum sections; shop fabricated, factory finished, with glass and glazing specified in Section 08 80 00 and installed by this Section; related flashings, anchorage and attachment devices.
   1. System to be reglazable from interior.

B. System Assembly: Site assembled.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, including building corners.

1. To design pressure indicated on Drawings, as tested in accordance with ASTM E330.

B. Deflection: Limit mullion deflection to 1/175 for spans under 13'-6" and 1/240 plus 1/4 inch for spans over 13'-6", with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.

D. Air Infiltration: Limit air leakage through assembly to 0.06 cfm/min/sq ft of wall area, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with AAMA 501.

E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with glass.

F. Water Leakage: None, when measured in accordance with AAMA 501 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbf/sq ft and maximum of 12.00 lbf/sq ft.

G. Thermal Transmittance of Assembly (Excluding Entrances): Maximum U Value of 0.69 Btu/sq ft per hour per deg F when measured in accordance with AAMA 1503.

H. Expansion / Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components and anchorage.

I. System Internal Drainage: Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior by weep drainage network.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface.

E. Design Data: Indicate framing member structural and physical characteristics and dimensional limitations.

F. Shading Performance: Manufacturer shall analyze system and provide written performance report for the Project glazing fitted with horizontal sun control devices using *Solector® Sun Shading Estimator Tool*.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Systems specified under this section and Section 08 41 13 Aluminum-Framed Entrances and Storefronts shall be provided by the same manufacturer.

C. Sun control devices mounted to aluminum curtainwall framing shall be manufactured by framing manufacturer or specifically approved in writing by framing manufacturer for use with the curtain wall system and shall not limit the curtainwall system warranty.

1.7 QUALIFICATIONS

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years' experience.

1.8 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.9 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual.

C. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section 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 caused by thermal movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components to function properly.
   2. Warranty Period: Two years from date of Substantial Completion.

C. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Arcadia Texas, www.arcadianc.com
B. Arch Aluminum & Glass Co., Inc. www.arch.amarlite.com
C. Columbia Commercial Building Products, www.ccbpwin.com
D. EFCO Corporation www.efcocorp.com
E. Kawneer www.kawneer.com
F. Tubelite Inc., www.tubeliteinc.com
G. United States Aluminum. www.usalum.com
H. Vistawall Architectural Products. www.vistawall.com

I. YKK AP America Inc., www.ykkap.com
J. Substitutions: Section 01 60 00 - Product Requirements

2.2 BASIS-OF DESIGN:

A. Exterior System: Kawneer 1600 Wall System™ 1-IR Curtain Wall: 2-1/2" face X 7-13/16" depth for 1-5/16-inch thick impact-resistant glazing system. Structural silicone glazed.

B. Interior System for Ballistic-Rated Glazing: Kawneer 1600 Wall System™ 1 Curtain Wall: 2-1/2" face X 7-11/16" depth for 1-3/16 inch thick glazing. Structural silicone glazed.

C. Interior System for Typical Interior Glazing: Kawneer 1600 Wall System™ 1 Curtain Wall or approved equivalent by a specified manufacturer: 2-1/2" face X 6-3/4" depth and 2-1/2" face X 7-11/16" depth as indicated; both depths for 1/4- inch thick glazing. Typical gasketed glazing.

2.3 COMPONENTS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209, 5005 alloy, H15 or H34 temper.

C. Sheet Steel: ASTM A653/A653M; galvanized to minimum G90.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections where needed for reinforcing; galvanized

E. Glass: Specified in Section 08 80 00.

F. Glazing Materials: Curtain wall manufacturer's standard types to suit application and to achieve weather, moisture, and air infiltration requirements.

G. Flashings: Minimum 0.032-inch thick aluminum to match mullion sections where exposed.

H. Sealant and Backing Materials:
1. Sealant Used Within System (Not Used for Glazing): Manufacturer's standard materials to achieve weather, moisture, and air infiltration requirements.
2. Perimeter Sealant: Specified in Section 07 90 00.

I. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum brackets and reinforcements. Provide nonstaining, nonferrous shims for aligning system components.

J. Fasteners: Manufacturer's standard stainless steel, compatible with adjacent materials.

K. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

L. Horizontal Sun Control Devices:

1. System: Curtain wall manufacturer's single blade aluminum sun control devices mounted on curtain wall framing.

2. Design Requirements: Design and size components to withstand design loads indicated on Drawings without damage or permanent set.

a. Blade deflection shall not exceed L/120 of span length.

b. Test horizontal sunshade configurations to meet a minimum load of 65 psf with a factor of safety of 1.5 times the design load.

c. Stresses resulting from thermal expansion/contraction and designed wind loading shall not cause permanent deformation of or disengagement from the glazed system.

d. Provide internal mullion reinforcing as required for mounting of sun control blades to mullions.

3. Basis of Design: *Versoleil*™ *SunShade – Single Blade System for Curtain Wall* as manufactured by Kawneer or approved equivalent by specified curtain wall manufacturer:
   a. Blade Size: 14-inches deep x width(s) indicated.
   b. Orientation: Horizontal.
   c. Attachment: Manufacturer's thermally broken attachment brackets allowing for thermal expansion and contraction.
   d. Finish: Clear anodized to match curtain wall framing.

2.4 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.

B. Fabricate sill pans with welded end dams at jambs and changes in sill height.

C. Fabricate frames for glazing from exterior.

D. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

E. Prepare components to receive anchor devices. Fabricate anchors.

F. Arrange fasteners and attachments to conceal from view.

G. Reinforce framing members for imposed loads.

2.5 SHOP FINISHING

A. Clear Anodized Aluminum Surfaces (Typical): AAMA 611, AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.

B. Concealed Steel Items: Galvanized to ASTM A123/A123M; minimum 1.2 oz/sq ft coating thickness; galvanize after fabrication.

C. Apply bituminous paint to concealed aluminum surfaces in contact with cementitious materials or dissimilar metals.

D. Touch-Up Primer for Galvanized Steel Surfaces: SSPC Paint 20 zinc rich.

E. Extent of Finish:
   1. Apply factory coating to surfaces exposed at completed assemblies.
   2. Apply touch-up materials recommended by coating manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions, tolerances, and method of attachment with other Work.

C. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION

A. Install wall system and sun control devices in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent Work.

E. Install sill pans. Turn up ends and edges; seal to adjacent Work to form water tight dam.

F. Coordinate attachment and seal of perimeter air and vapor retarder materials.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install integral flashings and integral joint sealers.

I. Coordinate installation of glass with Section 08 80 00; separate glass from metal surfaces.

J. Coordinate installation of perimeter sealants with Section 07 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust operating hardware and sash for smooth operation.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from pre-finished aluminum surfaces.

C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

D. Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect finished Work from damage.

END OF SECTION

SECTION 08 45 00 - TRANSLUCENT WALL AND ROOF ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aluminum framed vertical system with sandwich panels of translucent skins separated with continuous vertical supports.

B. Related Sections:
   1. Section 079000 - Joint Protection: System perimeter sealant and back-up materials.

1.2 REFERENCES

A. American Architectural Manufacturers Association:
   1. AAMA 501 - Methods of Test for Exterior Walls.
   2. AAMA 503 - Voluntary Specification for Field Testing of Metal Storefronts. Curtain Wall and Sloped Glazing Systems.
   3. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   4. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
   5. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
   6. AAMA CW-11 - Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing.
   7. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual.
   8. AAMA MCWM-1 - Metal Curtain Wall Manual.
   9. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.
   10. AAMA TIR-A1 - Sound Control for Aluminum Curtain Walls and Windows.

B. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
   1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   4. ASTM D635 - Standard Test Method for Rate of Burning and or Extent and Time of Burning of Plastics in a Horizontal Position.
   5. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
   6. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
   7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   8. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   9. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
   10. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
   11. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.

D. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

A. Panel System: Structurally reinforced translucent panel system, shop fabricated, factory prefinished, with related flashings, anchorage and attachment devices.

1.4 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall, including building corners.
   1. As calculated in accordance with ASCE 7, as tested in accordance with ASTM E330.

B. Wind-Borne Debris Loads: Design and size assemblies located less than 60 feet above grade to withstand the following loads:
   1. Within 30 feet of Grade: ASTM E1886 and ASTM E1996; large missile impact test.
   2. Within 60 feet of Grade: ASTM E1886 and ASTM E1996; small missile impact test.

C. Deflection: Limit mullion deflection to 3/4 inch, with full recovery of glazing materials.

D. System Assembly: Accommodate following without damage to system, components or deterioration of seals.
   1. Movement within system.
   2. Movement between system and perimeter framing components.
   3. Dynamic loading and release of loads.
   4. Deflection of structural support framing.
   5. Tolerance of supporting components.

E. Light Transmission: 24 percent.

F. Solar Heat Gain Coefficient: 0.24.

G. Thermal Resistance of Assembly: Maximum U-Value of 0.24 Btu/sq ft per hour per deg. F when measured in accordance with AAMA 1503.

H. Air Infiltration: Limit air infiltration through assembly to 0.06 cfm/sq ft. of wall area, measured at reference differential pressure across assembly of 1.57 psf as measured in accordance with AAMA 501.

I. Water Leakage: None, when measured in accordance with AAMA 501 with test pressure difference of 20 percent of design pressure, with minimum differential of 2.86 lbs/sq ft and maximum of 12.00 lbf/sq ft.

J. Expansion / Contraction: System to provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over 12 hour period without causing detrimental effect to system components.

K. System Internal Drainage: Drain water entering joints, condensation occurring in framing system, or migrating moisture occurring within system, to exterior by weep drainage network.

L. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside face of glazing panel and heel bead of glazing compound.

M. Not Permitted: Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of system.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, anticipated deflection under load, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, panel configuration, and internal drainage details.

D. Design Data: Provide framing member structural and physical characteristics, calculations, dimensional limitations.

E. Submit two samples 12 x 12 inches in size illustrating prefinished aluminum surface, specified panel with skins, infill panels glazing materials illustrating edge and corner.

F. Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.

G. Manufacturer's Installation Instructions: Submit special installation requirements.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual. Light Transmitting Plastics: Class CC1 defined by applicable code when tested in accordance with ASTM D635 in thickness for intended use.
   1. Self Ignition Temperature: Minimum 650 degrees F when tested in accordance with ASTM D1929.
   2. Smoke Developed Index: Maximum 450 when tested in accordance with ASTM E84 or maximum 75 when tested in accordance with ASTM D2843 in thickness for intended use.

B. Surface Burning Characteristics:
   1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience and approved by manufacturer.

1.8 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.
   1. Convene minimum one week prior to commencing work of this Section.

B. PRE-INSTALLATION MEETING
   1. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.
   2. Convene minimum one week prior to commencing work of this Section.

1.9 PRE-INSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Handle Products in accordance with AAMA MCWM-1 - Curtain Wall Manual.

C. Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Puncture wrappings at ends for ventilation.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements.

B. Do not install sealants when ambient temperature is less than 40 degrees F during and 48 hours after installation.

C. Maintain this minimum temperature during and after installation of sealants.

1.12 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 10 year warranty to include coverage for panel color change and fiberbloom.

PART 2 PRODUCTS

2.1 TRANSLUCENT WALL AND ROOF ASSEMBLIES

A. Manufacturers:
1. Kalwall Corp., www.kalwall.com.
2. Major Industries, Inc., www.majorskylights.com.
3. Substitutions: Section 016000 - Product Requirements.

B. Product Description: Factory assembled panels of translucent skins bonded to continuous aluminum ribs for vertical applications, factory prefinished, including perimeter flashings. Panels are self-supporting.

C. Basis-of-Design: Kalwall *Verti-Kal.*

2.2 COMPONENTS

A. Translucent Sandwich Panels: Bonded to both sides of structural extruded aluminum vertical ribs.
1. Exposed surfaces of exterior sheet chemically and permanently treated to protect against surface erosion and extreme weather conditions.
2. Exposed surface of interior sheets fire retardant to a flame/smoke rating of 25/450.
3. Panel Thickness: 4 inches.
4. Exterior Facing Sheets: Translucent White.
   a. Furnish high-impact face sheet if required to meet specified impact-resistance requirements.
5. Interior Facing Sheets: Translucent White.

B. Glazing Accessories: Manufacturer recommended type to suit application to achieve weather, moisture, and air infiltration requirements.

C. Extruded Aluminum: ASTM B221; 6063 alloy, T5 temper typical, 6061 alloy, T6 temper for extruded structural members.

D. Sheet Aluminum: ASTM B209, 3003 or 5005 alloy, H15, H16, or H34 temper.

E. Mullions: Aluminum; glazing stops of sufficient size and strength to provide bite on panels prior to and during glazing; drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system; internal mullion baffles to eliminate "stack effect" air movement within internal spaces.

F. Battens, Cover Strips, Cover Plates, and Integral Flashings: Extruded aluminum, to suit location and application; sized to rigidly retain panels in place.

G. Sealant and Backing Materials: As specified in Section 079000 of Types described below.
   1. Perimeter Sealant: High performance general purpose exterior nontraffic polyurethane.
   2. Sealant Used Within System (Not Used for Glazing): Exterior metal lap joint sealant at metal to metal joints, manufacturer recommended sealants at other locations.

H. Flashings: Secure with concealed fastening method.
   1. Aluminum: Minimum 0.032-inch thick, finish to match adjacent aluminum.
   2. Stainless Steel: Minimum-0.025 inch thick stainless steel, No. 4 satin directional polish.

I. Weather Seals: To suit application; non-bleeding; non-staining.

J. Fasteners: Stainless steel.

2.3 FABRICATION

A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments concealed from view.

E. Reinforce framing members for external imposed loads.

2.4 FACTORY FINISHING

A. Clear Anodized Aluminum Surfaces: AA-M12C22A41 non-specular as fabricated mechanical finish, medium matte chemical finish, and Architectural Class I 0.7 mils clear anodized coating.
   1. Conform to AAMA 611.

B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify dimensions, tolerances, and method of attachment with other work.

C. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive work of this section.

3.2 INSTALLATION

A. Install wall system in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

B. Install cellular panels with cells horizontal.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Install alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

F. Install sill and integral flashings.

G. Coordinate attachment and seal of perimeter air and vapor retarder materials.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install perimeter sealant to method required to achieve performance criteria, with backing materials, and installation criteria in accordance with Section 079000.

3.3 ERECTION TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

C. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

D. Sealant Space Between Panel System Members and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.4 MANUFACTURER'S FIELD SERVICES

A. Section 014000 - Quality Requirements: Manufacturers’ field services.

B. Translucent panel product manufacturers to provide field surveillance of installation of their products.

C. Monitor and report installation procedures, and unacceptable conditions.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Remove protective material from prefinished aluminum surfaces.

C. Wash down surfaces with solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect finished Work from damage.

END OF SECTION

SECTION 08 56 55 – BALLISTIC-RATED TRANSACTION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ballistic-rated fixed window.
   2. Ballistic-rated transaction tray.
   3. Speak-through capability.

B. Related Sections:
   1. Section 08 80 00 - Glazing: General glass requirements for factory-installed glazing provided under this section.

1.2 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of window required, including the following:
   1. Construction details and fabrication methods.
   2. Profiles and dimensions of individual components.
   3. Data on hardware, accessories, and finishes.
   4. Recommendations for maintaining and cleaning exterior surfaces.

C. Ballistics Certification: Manufacturer’s certification construction is identical to the Bullet Resistant assembly tested at an independent testing laboratory in accordance with UL752 and approved for Level 3 bullet resistance.

D. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
   1. Layout and installation details, including anchors.
   2. Window unit elevations at 3/4 inch = 1 foot scale.
   3. Full-size section details of typical composite members, including reinforcement and stiffeners.
   4. Hardware.
   5. Glazing details.
   6. Accessories.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed installation of transaction windows similar in material, design, and extent to those required for this Project and with a re

B. Record of successful in-service performance.

C. Single-Source Responsibility: Obtain transaction windows from one source and by a single manufacturer.

D. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of transaction windows and are based on the specific window types and models indicated. Other transaction window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 1 Section "Substitutions."

E. Manufacture Product Certificates:
1. For each type of security window: Certify Products meet or exceed specified requirements
a. Provide test reports from nationally accredited testing laboratory indicating and interpreting test results relative to compliance with performance requirements of installed assemblies.
b. Bullet Resistant Rating: Certify that the construction is identical to the Bullet Resistant assembly tested at an independent testing laboratory in accordance with UL752.

1.4 PROJECT CONDITIONS

A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating transaction windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.5 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: Minimum 1-year after date of Substantial Completion. Warranted failures include but are not limited to:
1. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Structural failures including deflections exceeding 1/4 inch.
3. Failure of welds.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Quickserv Corporation, www.quikserv.com.
2. Ready Access, www.ready-access.com. Must meet all specification requirements.
3. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis-of-Design: UL-rated *Level 3 Acrylic Baffle Window* with clear anodized aluminum frame, and 11”x10”x2” Deal Tray as manufactured by Quckserv or approved equivalent by specified manufacturer.
1. Factory-glazed in fixed stainless steel bullet-resistant frame.
2. Glazing – Clear acrylic in 1-1/4” thickness or greater as required to provide the required UL 752 Level 3 rating. Provide center glazing panel with ½” standoff for speak-through capability.
3. Protective Baffles: Twin vertical acrylic baffles (*Bandit Barrier*) for additional protection. All edges square, eased, and highly polished.
4. Size: 36” x 36” or as indicated in the drawings.

2.2 FABRICATION

A. General: Fabricate fixed window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect openings before installation. Verify that rough opening is sized correctly with level sill.
   1. Drywall surfaces shall be taped and floated and ready for painting.
   2. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.
   3. Metal surfaces shall be dry; clean; free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

3.2 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.

B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.

C. Separate dissimilar metals and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.

D. Refer to Division 7 Section "Joint Sealants" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.

3.3 CLEANING

A. Clean all exposed surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances.

B. Clean glass of pre-glazed units promptly after installing windows. Comply with requirements of Division 8 Section "Glazing" for cleaning and maintenance.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to transaction window manufacturer to ensure that window units are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:
1. Windows
2. Cabinets (casework), including locks in cabinets.
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:
1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 06 Section “Rough Carpentry”
3. Division 06 Section "Finish Carpentry”
4. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

    a. “Metal Doors and Frames”
    b. “Flush Wood Doors”
    c. “Stile and Rail Wood Doors”
    d. “Interior Aluminum Doors and Frames”
    e. "Aluminum-Framed Entrances and Storefronts"
    f. “Stainless Steel Doors and Frames”
    g. “Special Function Doors”
    h. "Entrances”
6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL - Underwriters Laboratories
1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute
   1. Sequence and Format for the Hardware Schedule
   2. Recommended Locations for Builders Hardware
   3. Key Systems and Nomenclature
   4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association
   1. NFPA 70 – National Electric Code
   2. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
   3. NFPA 101 – Life Safety Code
   4. NFPA 105 – Smoke and Draft Control Door Assemblies
   5. NFPA 252 – Fire Tests of Door Assemblies
   6. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
   7. TAS – Texas Accessibility Standards

D. ANSI - American National Standards Institute

   1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
   2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
   3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
   4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
   5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:
   1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
   2. Prior to forwarding submittal:

      a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
      b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
      c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

   1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

   2. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

      a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

    a. Wiring Diagrams: For power, signal, and control wiring and including:
        1) Details of interface of electrified door hardware and building safety and security systems.
        2) Schematic diagram of systems that interface with electrified door hardware.
        3) Point-to-point wiring.
        4) Risers.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format (only) as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.
3. Buy American Certification: Manufacturer is accredited under an accredited third-party Quality Control Program, including IAS AC472 and based upon chapter 17 of the International Building Code (IBC).

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Factory order acknowledgement numbers (for warranty and service)
    d. Name, address, and phone number of local representative for each manufacturer.
    e. Parts list for each product.
    f. Final approved hardware schedule edited to reflect conditions as installed.
    g. Final keying schedule
    h. Copies of floor plans with keying nomenclature
    i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
    j. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
    a. Fire door assemblies, in compliance with NFPA 80.
    b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:
1. Supplier: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Architect and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
   b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
   b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

   a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
   1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   2) Preliminary key system schematic diagram.
   3) Requirements for key control system.
   4) Requirements for access control.
   5) Address for delivery of keys.

2. Pre-installation Conference

   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

D. Regulatory Requirements:

1. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
2. Handles, pull, latches, locks, other operable parts:
   a. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
   b. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
   c. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
   d. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.
   e. Where powered door serves an occupancy of 100 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.

E. Buy American Compliance: Materials provided under work of this section shall comply with the following requirements:

1. Buy American Act of 1933 BAA-41 U.S.C., 10a - 10d
2. Buy American Act provision of section 1605 of the American Recovery and Reinvestment Act of 2009 (ARRA)

F. Texas Department of Insurance Windstorm Requirements: When project falls under the Texas Department of Insurance Windstorm Inspection Program for Inland II. All products, materials and installation systems shall be evaluated and approved by the Texas Department of Insurance, Windstorm Inspection Program, and listed in the TDI Product Evaluation Index or approved by the Windstorm Engineer as outlined below. Products, materials and installation systems not presently approved by the Texas Department of Insurance, Windstorm Inspection Program, may be considered for this project however, they must be properly submitted through the Architect for review. This submittal shall be a part of the initial

submittal process outlines in Section 013400 and requirements for this portion are detailed within the Texas Department of Insurance Windstorm Inspection website at the following location: www.tdi.state.tx.us/wind/submittal_requi.html.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks
            a) Schlage: 10 years
        2) Exit Devices
            a) Von Duprin: 10 years
        3) Closers
            a) LCN 4000 Series: 30 years
    b. Electrical Warranty
        1) Locks
            a) Schlage: 3 years
        2) Exit Devices
            a) Von Duprin: 3 years
        3) Closers
            a) LCN: 2 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners
    1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
    2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work,

to match finish of this other work including prepared for paint surfaces to receive painted finish.

3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
   1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
   2. Use materials which match materials of adjacent modified areas.
   3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation. All closers and exit devices on labeled wood doors shall be through bolted if required by the door manufacturer.
   1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. All hardware shall be installed with the Manufacturers standard screws as provided. The use of any other type of fasteners shall not be permitted. The general contractor shall provide wood blocking in all stud walls specified and/or scheduled to receive wall stops, No Exception.

2.03 HINGES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Ives 5BB series.

B. Requirements:
   1. Provide hinges conforming to ANSI/BHMA A156.1.
   2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
      a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
      b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
   3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
      a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
      b. Interior: Heavy weight, steel, 5 inches (127 mm) high
   4. 2 inches or thicker doors:
      a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
      b. Interior: Heavy weight, steel, 5 inches (127 mm) high
   5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
   6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
   7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
      a. Steel Hinges: Steel pins

b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins, as specified
e. Interior Non-lockable Doors: Non-rising pins

8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
10. At labeled door's steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

2.04 CONTINUOUS HINGES

A. Stainless Steel
1. Manufacturers:

a. Scheduled Manufacturer: Ives.

2. Requirements:

a. Provide pin and barrel continuous hinges conforming to ANSI/BHMA A156.26., Grade 1.
b. Provide pin and barrel continuous hinges fabricated from 14-gauge, type 304 stainless steel.
c. Provide twin self-lubricated nylon bearings at each hinge knuckle, with 0.25-inch (6 mm) diameter stainless steel pin.
d. Provide hinges capable of supporting door weights up to 600 pounds, and successfully tested for 1,500,000 cycles.
e. On fire-rated doors, provide pin and barrel continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
f. Provide pin and barrel continuous hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
g. Install hinges with fasteners supplied by manufacturer.
h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

B. Aluminum Geared
1. Manufacturers:

a. Scheduled Manufacturer: Ives.

2. Requirements:

a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.

e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
g. Install hinges with fasteners supplied by manufacturer.
h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

a. Scheduled Manufacturer: Von Duprin EPT-10.

B. Requirements:
1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:
1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:
1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 SURFACE BOLTS

A. Manufacturers:
1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:
1. Surface bolt s to have 1″ throw for maximum security with concealed mounting that prevents vandalism. Units to be constructed of heavy-duty steel and UL listed up to three (3) hours when used on the inactive door of a pair up to 8′ in height.

2.08 COORDINATORS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:
   1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
   2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers, surface vertical rod exit device strikes or other stop mounted hardware. Factory-prepared coordinators for vertical rod devices as specified.

2.09 CYLINDRICAL LOCKS

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Schlage ND series.
   2. Acceptable Manufacturers and Products: Sargent 10-Line, Falcon T.

B. Requirements:
   1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
   2. Cylinders: Refer to “KEYING” article, herein.
   3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
   4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
   5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
   6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
   7. Provide electrified options as scheduled in the hardware sets.
   8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

      a. Lever Design: Schlage RHODES.

2.10 PADLOCKS:

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Schlage KS Series.

B. Requirements:
   1. Provide padlocks with 1-inch (25 mm) shackle height, unless noted otherwise, as specified.
   2. Cylinders: Refer to “KEYING” article, herein.

2.11 EXIT DEVICES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: Von Duprin 99/33A series.
   2. Acceptable Manufacturers and Products: Sargent 80 series.
   3. Scheduled Manufacturer and Product: Von Duprin QEL (no substitutions)

B. Requirements:
   1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
   2. Cylinders: Refer to "KEYING" article, herein.
   3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
   4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
   5. Provide exit devices with dead latching feature for security and for future addition of alarm kits and/or other electrified requirements.
   6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
   7. Provide flush end caps for exit devices.
   8. Provide exit devices with manufacturer's approved strikes.
   9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
   10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
   11. Provide cylinder or hex-key dogging as specified at non-fire-rated openings.
   12. Provide dogging indicators (CDSI) for visible indication of dogging status where scheduled.
   13. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed. Provide MT54 Wall Kits (unless noted otherwise in hardware set).
   14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and were noted in hardware sets.
   15. Provide electrified options as scheduled.
   16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.12 CYLINDERS/KEYING/KEYS

A. Provide all exterior and interior locks or Exit Devices requiring cylinders keyed to the existing Large Format Interchangeable Core Master Key System as instructed by the Owners Representative. Cylinders shall comply with performance requirements of ANSI A156.5. All keys shall be of nickel silver material only. The hardware supplier shall meet with the General Contractor, Architect and the Owners Representative at the project jobsite to determine all permanent keying requirements.

B. Cylinders shall be factory keyed, and factory maintained as directed by the owners Representative and the Architect. Provide (3) keys per cylinder.

C. Factory stamp all keys "Do not duplicate" and with key symbol as directed by the Owners Representative. Visual key control shall be provided on all permanent keys and cylinders.

D. Provide temporary keyed construction cores for the duration of the construction phase. Provide ten (10) construction day keys and three (3) construction control keys. All construction cores shall be returned to the hardware supplier upon installation of permanent cores.

E. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Sargent Signature R-series keyway.
2. Alvin ISD uses a Sargent Signature Key System with a Sargent "R" Series Keyway.
3. Visual Key Control to be used. Key Set/Number (Example A1, A2 etc.) to be stamped on key and on the face of cylinders.
4. The GGGM is to be cut on an "RN" Signature key blank.
5. Control Key to be built into the system and cut on an "RN" Signature key blank.
6. All Master keys are to be cut on a Signature Key blank.
7. All Exterior door cylinders are to be Signature Cylinders except for any GGGM1-5 exterior doors
8. All interior openings, keyed dog downs, and mullions are to be standard cylinders, non-signature unless noted otherwise. All GGGM1-5 openings are to be standard cylinders. Non-Signature; GGGM1: Maintenance - GGGM2 : Custodial - GGGM3 : Technology - GGGM4: Future use - GGGM5 : Food Service.
9. Contractor will install final cores in all door hardware.
10. Contractor to provide.
    1 lockable surface mounted key cabinet with capacity of 3 times the number of key changes, including all number tags and record keeping accessories.
    (Commonly referred to as a "Deluxe 2 Tag System").
11. After verifying key functions on installed hardware, the contractor will hang key cabinet and place all keys on tags and hooks in cabinet as directed by the owner.
12. Key Quantity: Furnish in the following quantities.
    Contractor to provide:

- 5 each of the following keys: GGMK - GMK - MK - SMK
- 6 Master Keys (per Master Key Level/Group)
- 6 keys per change key number for all cores except the common key.
- 12 Athletics Cross Keys for Male Coaches and 12 for Female Coaches.
- 100 Common keys (Interior hallway doors, break rooms, lounge, etc.)
- 4 Interchangeable Core Padlocks and cores.
- 10 Uncombinated Cores
- 100 key blanks

13. The factory shall package cut keys and cores separately in key set sequence and ship all keys, cores, and padlocks to the contractor or Alvin ISD Project Manager.
14. Bittings are to be supplied electronically to be uploaded in Keywizard Software.

2.13 KEY CONTROL SYSTEM

A. Manufacturers:
   1. Scheduled Manufacturer: Telkee.
   2. Acceptable Manufacturers: HPC, Lund.

B. Requirements:
   1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

      a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
      b. Provide hinged-panel type cabinet for wall mounting.

2.14 DOOR CLOSERS

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product: LCN 4040XP series.
   2. Acceptable Manufacturers and Products: Sargent 351 series.

B. Requirements:
   1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certified closers. Stamp units with date of manufacture code.
   2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
   3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
   4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
   5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
   6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
   7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
   8. Pressure Relief Valve (PRV) Technology: Not permitted.
   9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117 or has special rust inhibitor (SRI).
   10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.15 DOOR TRIM

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:
   1. Provide push plates, push bars, pull plates, and pulls with diameter and length as scheduled.

2.16 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:
   1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
   2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.

3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.17 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturers: Glynn-Johnson.
   2. Acceptable Manufacturers: Rixson, Sargent.

B. Requirements:
   1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
   2. Provide friction type at doors without closer and positive type at doors with closer.

2.18 DOOR STOPS AND HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood.

B. Provide door stops at each door leaf:
   1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
   2. Where a wall stop cannot be used, provide universal floor stops.
   3. Where wall or floor stop cannot be used, provide overhead stop.
   4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.19 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:
   1. Scheduled Manufacturer: Zero International.
   2. Acceptable Manufacturers: National Guard, Reese.

B. Requirements:
   1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
   2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
   4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.20 SILENCERS

A. Manufacturers:
   1. Scheduled Manufacturer: Ives.
   2. Acceptable Manufacturers: Burns, Rockwood.

B. Requirements:
   1. Provide "push-in" type silencers for hollow metal or wood frames.
   2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
   3. Omit where gasketing is specified.

2.21 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets.

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.24 PROPRIETARY PRODUCTS

A References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.

All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and the Owners Representative.

Architect and the Owners Representative reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer’s brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. GC and Hardware Supplier to field-verify existing doors and frames receiving new hardware and existing conditions receiving new openings – prior to submittal/ordering. Verify that new hardware is compatible with existing door and frame preparation and existing conditions. Provide/replace all products/components necessary for complete, compliant, functioning opening.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:
   1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
   2. Field modify and prepare existing doors and frames for new hardware being installed.
   3. When modifications are exposed to view, use concealed fasteners, when possible.
   4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

      a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
      b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
      c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

H. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

I. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

J. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

K. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

L. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

M. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

N. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

O. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 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.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SETS

132563 OPT0391681 Version 1

Hardware Group No. 001 - OH DOOR

For use on Door #(s):

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MFR.		

-COORDINATE HARDWARE WITH DOOR MFR.

Hardware Group No. 001SL - SLIDING

For use on Door #(s):

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM) QTY/TYPE REQD	626	SAR
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MFR.		

-COORDINATE HARDWARE WITH DOOR MFR.

Hardware Group No. 103 - SGL OFFICE LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRANCE LOCK	ND53JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 103A - SGL OFFICE LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	ENTRANCE LOCK	ND53JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		

Hardware Group No. 201 - SGL STORAGE LOCK CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 201W - SGL STORAGE LOCK CLOSER WIDE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
3	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203 - SGL STORAGE LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203-CUST - SGL STORAGE LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS OUTSWING ONLY	630	IVE
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203S - SGL STORAGE LOCK OH STOP

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ	630	GLY
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203S-CUS - SGL STORAGE LOCK OH STOP

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203W - SGL STORAGE LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 205W - SGL STORAGE LOCK EXTERIOR

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S/18L (AS REQD)	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION

Hardware Group No. 212S - PAIR STORAGE LOCK OH STOP

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458-LENGTH REQD	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
2	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ	630	GLY
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT	AA	ZER

Hardware Group No. 341 - SGL PRIVATE TOILET - PRIVACY/INDICATOR CLSR

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 341-STF - SGL PRIVATE STAFF TOILET - KEYED LOCK/INDICATOR

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FACULTY RESTROOM/HOTEL W/ OUTSIDE INDICATOR	L9485L 06A L583-363 OS-OCC XL13-439	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 343 - SGL PRIVATE TOILET - PRIVACY/INDICATOR

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC	626	SCH
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

Hardware Group No. 403 - SGL PASSAGE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 501 - SGL CLASSROOM LOCK CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 501A - SGL CLASSROOM LOCK CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		

Hardware Group No. 501AH - SGL CLASSROOM LOCK FLOOR HOLDER (SERVING)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP SIZE REQD	652	IVE
1	EA	CLASSROOM LOCK	ND70JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS40/41 AS REQD SHCUSH AS REQD	626	IVE
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		

Hardware Group No. 503 - SGL CLASSROOM LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 503WS - SGL CLASSROOM LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ	630	GLY
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 553 - SGL STORAGE LOCK (CLASSROOM)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 553W - SGL STORAGE LOCK (CLASSROOM)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80JSARD RHO	626	SCH
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 710MC - PAIR EXIT DEV - (HM)

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	99-EO-SNB INACTIVE	626	VON
1	EA	PANIC HARDWARE	CD-99-L-NL-06-SNB	626	VON
3	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
2	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
2	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION
VERIFY KEYED MULLION/WALL KIT LOCATIONS W/OWNER PRIOR TO ORDERING

Hardware Group No. 711 - SGL EXIT DEV L-NL

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CD-99-L-NL-06-SNB	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION

Hardware Group No. 711-EL - SGL EXIT DEV L-NL

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-99-L-NL-06-SNB	626	VON
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION

Hardware Group No. 711A - SGL EXIT DEV (ALUM)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	PANIC HARDWARE	CD-99-NL-OP-110MD-SNB	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION

Hardware Group No. 714M-BOH - PAIR EXIT DEV EXTERIOR (HM) BACK OF HOUSE MECH/ELEC/RECV

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
2	EA	PANIC HARDWARE	LD-99-EO-SNB INACTIVE	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
2	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP	FS18S/18L (AS REQD)	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER
2	EA	DOOR CONTACT	BY SECURITY CONTRACTOR WHERE INDICATED		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION
VERIFY KEYED MULLION/WALL KIT LOCATIONS W/OWNER PRIOR TO ORDERING

Hardware Group No. 714M-ENT - PAIR EXIT DEV EXTERIOR (HM) ENTRY

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	LD-99-EO-SNB INACTIVE	626	VON
1	EA	PANIC HARDWARE	LD-99-NL-OP-110MD-SNB ACTIVE	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	90 DEG OFFSET PULL	8190-O 10" ACTIVE	630	IVE
2	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
2	EA	FLOOR STOP	FS18S/18L (AS REQD)	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER
2	EA	DOOR CONTACT	BY SECURITY CONTRACTOR WHERE INDICATED		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION
VERIFY KEYED MULLION/WALL KIT LOCATIONS W/OWNER PRIOR TO ORDERING

Hardware Group No. 714MA - PAIR EXIT DEV EXTERIOR (ALUM)

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	LD-99-EO-SNB INACTIVE	626	VON
1	EA	PANIC HARDWARE	LD-99-NL-OP-110MD-SNB ACTIVE	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	90 DEG OFFSET PULL	8190-O 10" ACTIVE	630	IVE
2	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
2	EA	FLOOR STOP	FS18S/18L (AS REQD)	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
2	EA	DOOR CONTACT	BY SECURITY CONTRACTOR WHERE INDICATED		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION
VERIFY KEYED MULLION/WALL KIT LOCATIONS W/OWNER PRIOR TO ORDERING

Hardware Group No. 801W - PUSH/PULL

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8303 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/EDA-TBSRT X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. C714MA - PAIR EXIT DEV EXTERIOR (ALUM) ACCESS CONTROLLED

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	LD-99-EO-SNB INACTIVE	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC ACTIVE	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	90 DEG OFFSET PULL	8190-O 10" ACTIVE	630	IVE
2	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
2	EA	FLOOR STOP	FS18S/18L (AS REQD)	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER
1	EA	CREDENTIAL READER	MT11 - BY DIVISION 28	BLK	SCE
3	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION
VERIFY KEYED MULLION/WALL KIT LOCATIONS W/OWNER PRIOR TO ORDERING

Hardware Group No. C715V - SGL EXIT DEV EXTERIOR (HM) ACCESS CONTROLLED - KITCHEN

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	DOOR PULL	VR910 NL SNB	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	ARMOR PLATE	8400 32" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S/18L (AS REQD)	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER
2	EA	VIEWER	698	626	IVE
1	EA	CREDENTIAL READER	MT11 - BY DIVISION 28	BLK	SCE
2	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
1	EA	DOOR BELL/BUZZER/INTERCOM	PROVIDE BY SECURITY (WHERE REQD)		B/O

DOOR VIEWERS MOUNTED AT 42" & 56" AFF (VERIFY HEIGHT WITH ARCHITECT)
NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION

Hardware Group No. CV710MAC - PAIR EXIT DEV (ALUM VEST) ACCESS CONTROLLED

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	LD-99-EO-SNB INACTIVE	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC ACTIVE	626	VON
2	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	90 DEG OFFSET PULL	8190-O 10" ACTIVE	630	IVE
2	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
2	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
1	EA	CREDENTIAL READER	MT11 - BY DIVISION 28	BLK	SCE
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
3	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION
VERIFY KEYED MULLION/WALL KIT LOCATIONS W/OWNER PRIOR TO ORDERING

Hardware Group No. CV711A - SGL EXIT DEV (ALUM VEST) ACCESS CONTROLLED

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	CYLINDER/CORE WITH CONSTR KEYING	63-TYP/QTY REQUIRED CKC (MATCH EXIST SYSTEM)	626	SAR
1	EA	90 DEG OFFSET PULL	8190-O 10" ACTIVE	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/EDA-SNB X MTG BRKT, SPCR/SUPPORT & PLATE AS REQ	689	LCN
1	EA	STOP AS REQD	WS406/407CCV/FS436-OH STOP AS REQD	630	IVE
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
1	EA	CREDENTIAL READER	MT11 - BY DIVISION 28	BLK	SCE
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
2	EA	DOOR CONTACT	BY SECURITY CONTRACTOR		B/O
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTE: PROVIDE SCUSH ARMS (ONLY) WHEN WALL/FLOOR STOP IS NOT AN OPTION

END OF SECTION

SECTION 08 74 00 – ACCESS CONTROL MONITORING SYSTEM

PART 1 – GENERAL

1.1 ACCESS CONTROL MONITORING SYSTEM (ACMS)

A. Related Documents
   1. Section 08.71.00 Door Hardware
   2. Building Security Systems Drawings

1.2 DESCRIPTION OF WORK:

A. Provide a complete Access Control Monitoring System (ACMS) turnkey installation as detailed in this and other sections of these specifications. The ACMS shall comprise the following:
   1. A computer-based ACMS having monitoring and control functionality, operator workstations, intelligent edge devices. The ACMS shall consist of Schlage Electronic Trims, Locks and other components located as described in this section for a complete turnkey electronic access control solution.
   2. The extent of the access system work is indicated herein, and by the contract drawings and schedules.
   3. The type of access control in this Section shall be hard-wired technology fully integrated with the door hardware described in section 08 71 00.
   4. The Owner shall provide the following Network Security Server, Operator Workstations and Local Area Network. All equipment must meet or exceed the minimum manufacturer's specifications for the Access Control Monitoring System.
   5. The access control software shall have the ability to assign ADA access to a specific credential.

B. Provide the following support for the ACMS facilities:
   1. Hardware Supplier and Installer shall provide a 1 year warranty on all components furnished.
   2. Submittals, samples and record documentation.
   3. Comprehensive commissioning and testing.
   4. Training services for the Owner and Operators.
   5. Coordination with other site contractors.
   6. Reporting to the owner and Architect for the coordinated and timely execution of the work.
   7. Maintenance services during the warranty period.
   8. All security equipment, cabling, and other components, materials and services required for a completed and fully operational turnkey ACMS installation meeting these specifications.

1.3 QUALITY ASSURANCE:

A. Manufacturer: Firms regularly engaged in manufacture of intrusion and access systems, of types, sizes, and electrical characteristics required, whose products have been satisfactorily used in similar service for not less than 5-years.

B. Installer: Shall be qualified with at least 5-years of successful installation experience on projects with intrusion detection and access control systems installations having work similar to that required for this Project. The subcontractor security contractor, installer, integrator) shall be Factory Certified on the supplied equipment and employ full time factory certified technicians.

1.4 ACMS TOPOLOGY

A. The ACMS shall have the following characteristics:
   1. The ACMS shall be configured to ensure reliability of systems operation and control of critical functions/systems. The following describes in very general terms the relationship between the various components of the ACMS that would be acceptable.
   2. The subcontractor shall coordinate the material needs with the Hardware Supplier and program the Open Options DNA Fusion Client Workstation that resides on the District's existing DNA Fusion Server. The DNA Fusion Client Workstations and ACPS (Access Control Panels) shall reside on the Security Local Area Network (LAN). The DNA Fusion Client Workstations shall provide the operators with a "window" into the ACMS for monitoring and control of the System. The Security LAN shall be a high speed Ethernet TCP/IP based network.
   3. The system shall have the capability for "Real Time" centralized lockdown in less than ten (10) seconds.
   4. Electronic locks shall be programmed to fail secure.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

   1. Convene minimum one week prior to commencing work of this Section.

PART 2 – PRODUCTS

2.1 LOCAL CONTROL PANEL COMPONETS:

A. Local control panel shall be Open Options SSP-EP (No Substitutions). Security Contractor shall provide quantities of material and licenses necessary to handle all devices, power supplies, function, and I/O zones as specified and/or required.

B. Control panel interface module shall be Open Options RSC-1 or RSC-2. Module shall interface with door hardware described in Section 08 71 00 and shall communicate with the SSP-EP utilizing the RS485 protocol.

2.2 EDGE DEVICES AND COMPONENTS:

A. Access control hardware shall be Schlage AD-300 (No Substitutions) Hard-wired equipment. The electronic locking hardware shall interface with the door hardware described in Section 08 71 00 and within this Section. Use Von Duprin Exit Device LD-RX-00EO-US26D for all doors receiving an AD-300 lock.

B. The AD-300 hard-wire locks shall communicate with the Open Options Control Panel utilizing the RS485 Protocol.

C. Local lockdown control hardware shall be STI Stopper Station with Bopper Stopper Cover **SS-2411 & CP-LBL** Emergency Push Button, color Blue, displaying factory custom phrase "LOCKDOWN DOORS" (No Substitutions) hardwired to Open Options Panel. The lockdown push button shall communicate with the DNA Fusion Software via the Open Options Control Panel to change all AD-300 locks to "Locked" mode upon activation, and automatically return to previous mode by resetting the push button.

2.3 CREDENTIALS:

A. Card credentials shall be XceedID Smart ISO Model # 9500 (No Substitutions). Card format and numbering shall be coordinated with AISD Access Control Systems Administrator prior to ordering. 100 cards shall be provided to the ACMS Administrator.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Install all components in strict accordance with manufacturer's printed instructions.

B. Test and adjust system to ensure system is fully and reliably operational.

C. Instruct Owner's representatives in settings, use, maintenance, and troubleshooting of ACMS system.

D. All hardware related and connected to access Control equipment shall be provided, installed and programmed by Open Options Certified Integrator.

E. Door Position Switch shall be installed in top edge of access-controlled door only.

F. Install 299 Strike (provided with Von Duprin Exit Device) on mullion for exit device installed on access-controlled door.

G. Request to Exit and Door Position switches shall be properly installed to display proper door status in DNA Fusion Workstation, without false reporting.

PART 4 – SCHEDULE (Actual hardware sets and quantities used will be referenced in the Hardware Section 08 71 00)

END OF SECTION

SECTION 08 80 00 – INTERIOR GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes glass and glazing for the following:
   1. Interior windows.
   2. Door lights at interior doors.
   3. Standard glazing for interior storefront systems.
   4. Laminated glazing for glass railing systems.
   5. Laminated glazing to meet Forced Entry requirements.
   6. Glass and glazing accessories and installation requirements are included in this section for other sections referencing this section.

B. Related Sections:
   1. Section 07 90 00 - Joint Protection: Sealant and back-up material other than glazing sealants.
   2. Section 08 11 13 - Standard Steel Doors and Frames: Glazing in interior steel doors and windows.
   3. Section 08 14 16 - Flush Wood Doors: Interior door lights.
   4. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
   5. Section 08 56 54 – Ballistic Rated Transaction Windows: Polycarbonate panel system.
   6. Section 08 88 56 – Security Glazing: Ballistic and impact-resistant glazing.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings Safety.

B. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
   1. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
   2. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   3. ASTM C1036 - Standard Specification for Flat Glass.
   4. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
   5. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. Consumer Products Safety Commission:
   1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.

E. Glass Association of North America:
   1. GANA - Sealant Manual.
   2. GANA - Glazing Manual.
   3. GANA - Laminated Glass Design Guide.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glazing, tape sealants, gaskets, and glazing channel substrates.
3. Test no fewer than eight samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.4 PERFORMANCE REQUIREMENTS

A. Glass Thickness: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Wind Loads: As indicated, but not less than wind loads required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
   2. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      a. Load Duration: 3 seconds.
   3. Maximum Lateral Deflection: For exterior glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
   4. Minimum Glass Thickness for Exterior Lites: Not less than 1/4 inch.

B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Thermal and Solar Optical Performance: Measured or calculated in accordance with the following:
   1. U-Values: NFRC 100.
   2. Solar Heat Gain Coefficients: NFRC 200.
   3. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Glass and Plastic: Provide structural, physical, and thermal and solar optical performance characteristics, size limitations, special handling or installation requirements.
   2. Glazing Sealants, Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

C. Samples:
   1. Glass: Submit two samples 12x12 inch in size, of each type and color of glass specified, including spandrel, wire glass, insulated metal panels, and other glazing types as may be indicated.
   2. Glazing Materials: Submit 12-inch-long bead of glazing sealant for each color other than black.

D. Manufacturer's Certificate: Certify sealed insulating glass and low-E coated glass meet or exceed specified requirements.

E. Installer's Certificate: Certify glass furnished without identification label is installed in accordance with Construction Documents and applicable code.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired-glass, ANSI Z97.1.
   1. Obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
   2. Where glazing units are specified for lites more than 9 sq. ft. in exposed surface area, and lites of any size in certain hazardous locations such as sliding glass doors, doors and enclosures for bathtubs, showers, hot tubs, whirlpools, saunas, and steam rooms, provide glazing products that comply with Category II materials; for lites 9 sq. ft. or less in exposed surface area, provide glazing products that comply with Category I or II materials.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.8 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish ten-year warranty to include coverage for coated glass units from coating deterioration or failure, and replacement of same.

C. Furnish ten-year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Typical Glazing:
   1. Guardian Glass, www.guardianglass.com
   2. Oldcastle Building Envelope www.oldcastlebe.com
   3. Pilkington North America, Inc. www.pilkington.com
   4. Viracon www.viracon.com
   5. Vitro Architectural Glass (PPG) www.ppg.com
   6. Substitutions: Section 01 60 00 - Product Requirements

B. Fire Rated Glazing:
   1. SaftiFirst™ Fire Rated Glazing Solutions, www.safti.com.
   2. Substitutions: Section 01 60 00 – Product Requirements.

2.2 MATERIALS

A. **TYPE GL-4**: Tempered glass; ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering; furnish tempered glass conforming to CPSC 16 CFR 1201 Category II.
   1. Clear Tempered Glass: Class 1 clear; minimum 1/4-inch thick.
   2. Locations: Use for all interior glazing except Security Glazing and polycarbonate systems.

B. **Type GL-5**: Single-pane laminated glass at interior railing systems.
   1. Fabrication: Two fully tempered 3/8” glass plies bonded with an interlayer complying with ASTM C1172.
   2. Total Thickness: Nominal ¾-inch.
   3. Plastic Interlayer: Clear polyvinyl butyral.
   4. Installed system shall comply with safety glazing requirements of the International Building Code (IBC) Section 2407 for guards, including ANSI Z97.1 Class A rating.
   5. Glass panels shall meet performance tests including impact resistance and load requirements per ASTM E2358, Standard Specification for the Performance of Glass in Permanent Glass Railing Systems, Guards, and Balustrades.
   6. Finish and protect edges to prevent delamination.
   7. Sizes and mounting method per manufacturer’s recommendations, fully supported at minimum edges or fixed with approved hardware.

C. **Type GL-7**: Single-pane laminated glass at interior storefront systems, fixed windows, and door lights at security vestibules.
   1. Fabrication: 1/4” clear annealed glass + 0.09” PVB interlayer + 1/4” clear annealed glass.
   2. Total Thickness: Nominal 9/16 inch.
   3. Plastic Interlayer: Clear polyvinyl butyral.
   4. Installed system shall meet TEA requirements and UL 972 for Delayed Forced Entry.

2.3 GLAZING ACCESSORIES

A. Dense Gaskets: Resilient extruded shape to suit glazing channel retaining slot; black color.
   1. Neoprene: ASTM C864.
   2. EPDM: ASTM C864.
   3. Silicone: ASTM C1115.

B. Soft Gaskets: ASTM C509 Type II; resilient extruded shape to suit glazing channel retaining slot; black color.
   1. Neoprene.
   2. EPDM.
   3. Silicone.

C. Pre-Formed Glazing Tape: Size to suit application.
   1. Preformed butyl compound with or without integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; black color.
      a. Butyl Corner Sealant: ASTM C920 single component non-skinning butyl compatible with glazing tape; color to match tape.
      b. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

D. Setting Blocks: Elastomeric material recommended by glass manufacturer, 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

E. Spacer Shims: Elastomeric material recommended by glass manufacturer, 50 to 60 Shore A durometer hardness, minimum 3-inch long x one half the height of glazing stop x thickness to suit application, self-adhesive on one face.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings for glazing are correctly sized and within acceptable tolerance.

C. Verify surfaces of glazing channels or recesses are clean, free of obstructions impeding moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

A. Perform installation in accordance with GANA Glazing Manual.
1. Glazing Sealants: Comply with ASTM C1193.
2. Do not allow metal-to-glass contact.

B. Interior Dry Method (Tape and Tape) Installation:
1. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.
2. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
4. Place glazing tape on free perimeter of glazing in same manner described above.
5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Knife trim protruding tape.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove glazing materials from finish surfaces.

C. Remove labels after Work is complete.

D. Clean glass and adjacent surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 08 88 56 – BALLISTIC AND IMPACT-RESISTANT GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazed systems for the following products and applications of the following types:
   1. Glazing Types:
      a. Interior Ballistics-Rated Glass: Laminated all-glass sheets.
      b. Exterior Impact-Resistant Glass: Insulated dual-pane all-glass sheets.

   2. Framing Types
      a. For Interior Ballistics-Rated Glass: Ballistic Resistant aluminum storefront framing provided under Section 08 41 13.
      b. For Exterior Impact-Resistant Glass: Impact-resistant aluminum storefront framing provided under Section 08 41 13 and Impact-Resistant aluminum curtain wall framing provided under Section 08 44 13.

B. Related Sections:
   1. Section 08 41 13 - Aluminum Framed Entrances and Storefronts: Both standard and impact-resistant aluminum framing for interior and exterior glazing, including ballistics-resistant interior glazing.
   2. Section 08 44 13 - Glazed Aluminum Curtain Walls: Impact-resistant aluminum curtainwall system for exterior security glazing.
   3. Section 08 80 00 – Typical Interior Glazing.
   4. Section 08 88 56 – Ballistic Rated Transaction Windows: Bullet-resistant polycarbonate protective vision panel system.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
   2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glazing, tape sealants, gaskets, and glazing channel substrates.
   3. Test no fewer than eight samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
   4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.3 REFERENCES

A. American Society of Civil Engineers:
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International:
   1. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
   2. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   3. ASTM C1036 - Standard Specification for Flat Glass.
   4. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

5. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

C. Consumer Products Safety Commission:
1. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing.

D. Glass Association of North America:
1. GANA - Sealant Manual.
2. GANA - Glazing Manual.
3. GANA - Laminated Glass Design Guide.

E. Underwriters Laboratories:
1. UL 752 Testing for Ballistic Resistance at the ballistic levels.

1.4 SUBMITTALS

A. Product Data: Manufacturer's literature and testing data for each type of product indicated.

B. Ballistic-Resistant Glazing Samples: For each type of glazing unit; (2) nominal 6-inch square panels.

C. Glazed System Schedule and Shop Drawings:
1. Indicate glazing and framing types and sizes in overall plan drawing for each size opening and location. Use same designations indicated on Drawings.
2. Indicate all frame sections, glazing panel thickness, and all head, jamb, sill and intermediate details.

D. Product Certificates: For each type of product indicated, from manufacturer.

E. Preconstruction adhesion and compatibility test reports.

F. Warranties: Sample of manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Approved in writing by the security glazing manufacturer for the specific Project.
2. A qualified installer who employs glazing installers for this Project who are certified under the National Glass Association Glazier Certification Program.
3. Installation company can provide information completion of at least ten projects of similar size and scope within the past three-years.

B. System Qualifications:
1. Ballistic-rated glazing installed in this Project shall meet all testing requirements of Underwriters Laboratories UL 752 Testing for Ballistic Resistance at the ballistic level(s) specified.
2. Impact-resistant glazing installed in this Project shall meet testing requirements of ASTM F1233 at the impact-resistant level(s) specified.

C. Source Limitations for Security Glazing:
1. Obtain ballistics-rated glazing from single source manufacturer using the same type of lites, plies, interlayers, and spacers for each glazing type indicated.
2. Obtain impact-resistant glazing from single source manufacturer using the same type of lites, plies, interlayers, and spacers for each glazing type indicated.

D. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below, unless more stringent requirements are

indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."

E. Glass Labeling: Permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name and ballistic-resistant rating.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient or substrate temperature conditions are outside limits permitted by glazing material manufacturer 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 below 40-deg. F.

1.9 COORDINATION

A. Coordinate dimensions, including thickness, of security glazing and framing with dimensions of construction that receives security glazing.

1.10 WARRANTY

A. Manufacturer's standard warranty for ballistics-resistant glazing: System manufacturer agrees to replace materials that deteriorate or show defects within specified warranty period. Defects include delamination, interlayer yellowing, or observable loss of light transmission, failure of ballistics-resistance or impact-resistance at specified level(s).

1. Glazing Warranty Period: 5-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SECURITY GLAZING

A. Manufacturers
1. Ballistic Glass & Armor Solutions, LLC; www.ballisticglassandarmor.com
2. Armortex, Inc., www.armortex.com
3. Insulgard Security Products, www.insulgard.com
4. Oldcastle Building Envelope, www.obe.com
5. Pacific Bulletproof, www.pacificbulletproof.com

6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 DESIGN OF SYSTEMS, GENERAL

A. Glazing Thickness and Layers: Where thickness is indicated, it is a minimum required thickness. Provide glazing in increased thicknesses as needed to comply with requirements indicated.

B. Framing Dimensions: Coordinate with framing contractor to ensure that frames provided have glazing gaps compatible with the proposed glazing thicknesses.
   1. Rabbet depth: 1-1/4”

C. Tempered Glass:
   1. ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering; furnish tempered glass conforming to CPSC 16 CFR 1201 Category II.
   2. Clear Tempered Glass: Class 1 clear.

D. Polycarbonate Sheet: Not applicable.

E. Low-E Coating: ASTM C1376, vacuum deposited, low-E coating applied to No. 2 face of clear glass in insulated panels for exterior glazing.
   1. Basis-of-Design: Guardian SNE50 or approved equivalent as required to meet Energy Code requirements for both clear and colored glass panels.

F. Laminated Units: All-glass laminated with clear polyvinyl butyral interlayer that complies with ASTM C 1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C 1349 for maximum allowable laminating process blemishes and haze.

G. Glazing Sealants
   1. Compatibility: Provide glazing sealants that are compatible with materials they will contact, including glazing channel substrates
   2. VOC Content: For sealants used inside, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
   3. Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

H. Glazing Tapes
   1. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
      a. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
      b. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure

   2. 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:
      a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
      b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

I. Glazing Gaskets: Provided as integral part of aluminum framing system.

J. Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of ballistics-resistant glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

2.3 SYSTEM TYPES

A. Exterior Insulated Impact-Resistant Glass:
1. **TYPE GL-1**: Dual-pane system ASTM E2190 certified by Insulating Glass Certification Council; with aluminum and silicone edge seal; black edge seal color; purge interpane core space with dry hermetic air.
2. Basis of Design: Hurricane-Rated system manufactured by Guardian or approved equivalent by a specified manufacturer.
3. Total Unit Thickness: 1-5/16” minimum, including nominal 1/2" dry air core.
4. Outer Pane: Clear tempered glass 1/4" thickness with specified low-E coating applied to number 2 surface.
5. Inner Pane: Clear laminated glass consisting of 2-plies of 1/4” heat-strengthened glass bonded together with 0.090 SGP clear interlayer. Pane thickness nominal 9/16".

a. Thermal Performance - Nominal Values:
1) U-Value Winter: 0.29.
2) U-Value Summer: 0.27.
3) Solar Heat Gain Coefficient: 0.23.
4) Light to Solar Gain: 2.22.

b. Optical Performance - Nominal Values:
1) Visible Light Transmittance: 51%.
2) Visible Light Reflectance Outside: 12%.

B. Exterior Insulated Impact-Resistant Colored Glass:
1. **TYPE GL-2** : Same construction and hurricane rating as Type **GL-1**, except interlayer of inner pane is 0.090 SGP color as manufactured by *Vanceva*. Colors to be selected by Architect.

C. Exterior Insulated Impact-Resistant Spandrel Glass:
1. **TYPE GL-3**: Same construction and hurricane rating as Type **GL-1**, except Outer Pane is 1/4" spandrel glass; Type 1, Quality Q3 flat fully tempered clear glass with opaque ceramic coating on number 2 surface. Color to be selected by Architect.

D. Interior Bullet-Resistant Glass:
1. **TYPE GL-6**: Non-insulated, clear, all-glass laminate with 0.090 SGP interlayer. Unit is designed to flex and absorb the energy of a bullet.
2. Basis of Design: *BGAS 3-2001-LS* as manufactured by Ballistic Glass & Armor Solutions or approved equivalent all-glass laminated unit by a specified manufacturer.
3. Total Thickness: as required to meet Ballistic Resistance performance requirement.
4. Total Weight: 12.5 - 14.7 lbs. /ft^2.
5. System Performance
a. Ballistic Resistance: **Level 3** per UL 752 for any trajectory or angle to threat side.
b. Designed for conventional installation and glazing methods.

2.4 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Interior glazing gaskets: preset sponge gasket, closed cell, non-staining EPDM with trim lip and factory molded corners meeting ASTM C509-06 EPDM specifications, Type ll Option 1 and C-864-06. Use no PVC material.

C. Setting Blocks: Thermoplastic polyolefin rubber; “Santoprene” as manufactured by Exxon Mobile Corp. Type A, durometer hardness of 85, plus or minus 5.

D. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

E. Spacers: Elastomeric blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain glazing units in place for installation indicated.

F. Edge Blocks: Elastomeric material of hardness needed to limit security glazing lateral movement (side walking).

2.5 FABRICATION OF SYSTEMS

A. Fabricate security glazing 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 for security glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face and edge clearances.
3. Effective sealing within 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 security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing, impair performance, or impair appearance.

C. Apply primers to 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 glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.

F. Provide spacers for security glazing lites where the length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. 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 performance requirements.
   2. Provide 1/8-inch minimum bite of spacers on glazing lites 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 security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and according to requirements in referenced glazing publications.

H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set coated security glazing with proper orientation so that coatings face exterior or interior 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 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 securely in place between glazing unit and frame or fixed stop, with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center security glazing 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 security glazing. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 TAPE GLAZING: Not applicable for gasketed frames

3.6 SEALANT GLAZING (WET): Not applicable for gasketed frames.

3.7 PROTECTION AND CLEANING

A. Protect exterior security glazing from damage immediately after installation by attaching crossed streamers to framing held away from glazing unit. Do not apply markers to security glazing surfaces. Remove nonpermanent labels, and clean surfaces.

B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer.

C. Examine security glazing 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; remove as recommended in writing by security glazing manufacturer.

D. Remove and replace security glazing that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, or vandalism during construction period.

E. Wash security glazing on exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

END OF SECTION

SECTION 08 91 00 - LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fixed louvers, frames and accessories.

B. Related Sections:
   1. Section 07 90 00 - Joint Protection: Sealant at louver perimeter.
   2. Division 23 Sections – HVAC ducting with direct connections to louvers.

1.2 REFERENCES

A. ASTM International:
   1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 PERFORMANCE REQUIREMENTS

A. As follows, determined by testing units 48 inches wide by 48 inches high per AMCA Standard 500:
   1. Louver Free Area: Nominal 50% or not less than 7.81 sq. ft.
   2. Static Pressure Loss: Not more than 0.14 inch water gage at an airflow of 810 fpm free area intake velocity.
   3. Water Penetration: Not more than 0.02 oz. per sq. ft. of free area at an airflow of 855 fpm free area velocity when tested for 15 minutes.

B. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blank-out areas required, and frames.

C. Product Data: Submit data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

D. Samples: Submit two samples illustrating finish and color of exterior surfaces.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AMCA Certification for Water Penetration, Air Performance, and Wind Driven Rain, in compliance with AMCA 500-L. Attach AMCA seal to louvers.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with installation of metal siding and masonry flashings.

C. Coordinate Work with installation of mechanical ductwork.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish twenty-year manufacturer warranty for louvers.

C. Warranty: Include coverage for degradation of fluoropolymer finish.

PART 2 - PRODUCTS

2.1 LOUVERS

A. Manufacturers:
1. Airline Products Co.
2. Airolite Co. www.airolite.com
3. Airstream Products www.pennvent.com
4. Construction Specialties, Inc. www.c-sgroup.com
5. Reliable Metal Products. www.reliablelouvers.com
6. Ruskin Mfg. www.ruskin.com
7. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Aluminum Sheet: ASTM B209, alloy 3003 or 5005, temper as required to produce required finish.

B. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.

C. Flashings: Of same material and finish as louver frame.

D. Sealants: As specified in Section 07 90 00.

2.3 COMPONENTS

A. Wall Louvers - Non-Drainable Style
1. Louver Construction: Aluminum.
2. Louver Depth: 6-inches, unless otherwise indicated.
3. Frame Type: Channel flange.
4. Frame Thickness: 0.081 inch.
5. Louver Blade Thickness: 0.081 inch.
6. Louver Blade Profile: Plain blade with no center baffle.
7. Louver Blade Angle: 37 1/2 degrees.
8. Louver Blade Spacing: 3".

2.4 ACCESSORIES

A. Bird Screen: Interwoven 1/4-inch mesh of 0.063 inch diameter aluminum wire.

B. Fasteners and Anchors: Stainless steel type.

C. Blank-Out Sheeting on Interior of Louver: Same material and finish as louver and frame:
1. Configuration: Single sheet.

2.5 FABRICATION

A. Louver Frame: Mechanically fastened corner joints. Form perimeter of frames with recessed channel to retain backer rod for sealant application.

B. Intermediate Mullions: Concealed, of extruded aluminum, profiled to suit louver frame.
1. Space at 7- inches o.c. or as recommended by manufacturer.

C. Sill Extensions: Provide sill extensions and loose sills made of same material as louvers where required for drainage to exterior.

D. Screens: Install screen mesh in channel-shaped frame; reinforce corner construction.

2.6 FACTORY FINISHING

A. Aluminum - Painted Finish: Manufacturer's 2 coat fluoropolymer finish with minimum 50 percent polyvinylidene fluoride resin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify prepared openings and flashings are ready to receive Work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Install louvers level and plumb.

B. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

C. Secure louvers in opening framing with concealed fasteners.

D. Install bird screen and frame to interior of louver. Attach to frame with stainless steel machine screws.

E. Attach blank-off sheet to back of frame with stainless steel sheet metal screws.

F. Install perimeter sealant and backing rod in accordance with Section 07 90 00.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements - Final cleaning.

B. Strip protective finish coverings.

C. Clean surfaces and components.

END OF SECTION

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Metal stud wall framing.
2. Metal channel ceiling framing.
3. Gypsum board and joint treatment.
4. Rated shaft wall assemblies.
5. Impact-Resistant gypsum board.
6. Glass mat gypsum sheathing board.
7. Acoustic insulation and sealant.

B. Related Sections:
1. Section 05 40 00 - Cold-Formed Metal Framing.
2. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking attached to metal stud framing.
3. Section 08 31 13 - Access Doors and Frames: Metal access panels.

1.2 REFERENCES

A. ASTM International:
1. ASTM C475 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
3. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
4. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
5. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
6. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
7. ASTM C1002 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
8. ASTM C1178 - Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
9. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
10. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
13. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:
1. GA 214 - Recommended Levels of Gypsum Board Finish.
2. GA 216 - Application and Finishing of Gypsum Board.
3. GA 600 - Fire Resistance Design Manual Sound Control.

C. Intertek Testing Services (Warnock Hersey Listed):
1. WH - Certification Listings.

D. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on metal framing, gypsum board, cementitious backer board, glass mat sheathing, joint materials, acoustic insulation and sealant, and fasteners.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840.

B. Fire Rated Wall and Ceiling Construction: Rating as indicated on Drawings, tested in accordance with ASTM E119.
   1. Fire Rated Ceilings and Partitions: Listed assembly by UL, WH, or GA.
   2. Fire Rated Shaft Wall Requirements: Listed assembly by UL, WH, or GA.

C. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

PART 2 - PRODUCTS

2.1 FRAMING MATERIALS

A. Manufacturers:
   1. ClarkDietrich Building Systems, www.clarkdietrich.com.
   2. General Rolling Mills., www.generalrollingmills.com.
   3. Marino\Ware, www.marinoware.com.
   4. Phillips Manufacturing, www.phillipsmfg.com.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Studs: ASTM C645, galvanized sheet steel, C shape, 25 gage thick, depth as indicated.
   1. Furnish 20 gage studs at the following locations:
      a. Studs framing doors.
      b. Walls finished with tile.
      c. Walls finished with abuse resistant gypsum board.
      d. Studs supporting wall-mounted accessories and TV brackets.

C. Tracks: ASTM C645, galvanized sheet steel, depth and thickness to match studs.

D. Deep-Leg Deflection Track: ASTM C645, with 2-inch deep flanges, thickness to match studs.

E. Grid Suspension System for Interior Ceilings: ASTM C645, direct-hung system composed of main beams and interlocking cross-furring members.
   1. Manufacturers:
      a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
      b. USG Interiors, Inc.; Drywall Suspension System.

F. Furring, Framing, and Accessories: ASTM C645.

G. Fasteners: ASTM C1002; Type S; length to suit application.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

I. Suspension Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625 inch diameter wire, or double strand of 0.0475 inch diameter wire.

2.2 GYPSUM BOARD MATERIALS

A. Manufacturers:
1. American Gypsum Co., www.americangypsum.com.
2. Georgia-Pacific Gypsum, www.gp.com
3. National Gypsum Company, www.nationalgypsum.com
4. Temple-Inland Inc., www.templeinland.com
5. USG Corporation www.usg.com

B. General: All specified types shall meet the following requirements unless otherwise noted:
1. Conform to ASTM C1396 section 5 (C 36), Grade X fire- resistant.
2. Ends square cut, tapered long edges wrapped.
3. 5/8” gypsum core faced and edge-wrapped with mold and moisture resistant 100% recycled paper.
4. Surface Burning Characteristics per ASTM E 84:
   a. Flame Spread = 0
   b. Smoke Developed = 0.
5. Intended for interior applications only.

C. Typical Gypsum Board Panels:
1. Basis of Design: FireBloc® Type X as manufactured by American Gypsum or approved equivalent by specified manufacturer.
2. Use throughout the interior of the Project except for specialized uses and locations requiring other panel types as indicated below.

D. Moisture-Resistant Gypsum Board:
1. Basis of Design: AquaBloc® Type X as manufactured by American Gypsum or approved equivalent by specified manufacturer.
2. 5/8” water-resistant gypsum core faced with mold and moisture resistant 100% recycled green-color paper
3. Water Absorption: Less than 5% per ASTM 1396.
4. Use at restrooms, shower rooms, custodial rooms and other areas subject to high moisture. Where board is not surfaced with tile, prepare for finish painting.
   a. Behind wall tile.
   b. Toilet room walls not receiving cementitious backer board.

E. Impact-Resistant Gypsum Board:
1. Basis of Design: M-Bloc® IR Type X Impact-Resistant board as manufactured by American Gypsum or approved equivalent by specified manufacturer.
2. 5/8” abuse, fire, mold and moisture-resistant fiberglass mesh reinforced gypsum core faced with mold and moisture resistant 100% recycled blue-color paper, and brown paper backing. fiberglass mesh fabric embedded into the core adjacent to the back of the panel to provide additional impact and penetration resistance
3. Abrasion-Resistance: Level 3 per ASTM C1629.
4. Indentation-Resistance: Level 1 per ASTM C1629.
5. Water Absorption: Less than 5% per ASTM 1396.
6. Use at locations as indicated in the drawings.

F. Fire Rated Assemblies:

1. Furnish one of the Type X panels specified above that meet the requirements for the specified fire rated assembly as well as the respective use and location requirements for Typical or Moisture-Resistant panels.

2. Furnish Type C gypsum board panels only where specifically indicated or where otherwise required for the indicated fire rated assembly.
   a. Basis of Design: FireBloc® Type C as manufactured by American Gypsum or approved equivalent by specified manufacturer.
   b. 5/8” Type X gypsum core with enhanced fire-resistant properties.

2.3 CEMENTITIOUS BACKER BOARD

A. Manufacturers:
   1. Custom Building Products; Wonderboard Cement Backerboard.
   2. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   3. National Gypsum Company; PermaBase Cement Board.
   4. USG Company; DUROCK Cement Board.

B. Cementitious Backer Board: ASTM C1325; High density, glass fiber reinforced, 1/2 inch thick; 24 inch wide, coated glass fiber tape for joints and corners.
   1. All shower walls.
   2. Wet walls behind lavatories, toilets, and urinals, and side walls adjacent to these fixtures.

2.4 GLASS MAT GYPSUM SHEATHING BOARD

A. Manufacturers:
   1. GlasRoc; BPB America Inc., www.glasroc.com.
   2. Dens-Glass Gold, Georgia-Pacific Gypsum, www.gp.com.
   3. GreenGlass, Temple-Inland, Inc., www.templeinland.com.
   4. Securock, USG Corporation, www.usg.com.

B. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, paperless, with glass mat facing on, or embedded into, each side of a water-resistant gypsum core; 48 x 96 inch size, 1/2 inch thick.

C. Fasteners: ASTM C954; steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

2.5 ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced, thickness to match studs.
   1. If required by fire-resistance requirements for fire rated walls, furnish mineral fiber insulation complying with ASTM C665, Type I.

B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

C. Gypsum Board Accessories: ASTM C1047; galvanized steel, aluminum coated steel, or rolled zinc; corner beads, edge trim, and expansion joints.
   1. Furnish Type LC bead at exposed panel edges.
   2. Furnish rolled zinc material at exterior locations.

D. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

E. Joint Materials: ASTM C475; reinforcing tape, joint compound, and water.

F. Gypsum Board Screws: ASTM C1002, Type S; length to suit application.
   1. Use screws complying with ASTM C954 for fastening panels to cold formed metal framing specified in Section 05 40 00.
   2. Use screws recommended by manufacturer for fastening cementitious backer board to metal framing.

G. Knee-Wall Bracing

1. 2” x 2” x 1/8” wall steel tube fully-welded to 3-1/2” x 5” deep x 1/4” thick steel base plate with (4) pre-punched mounting holes.
2. Product: *SKB Knee Brace Kit* as manufactured by Softforms, www.kneewall.com, or approved equivalent.
3. Fasteners: 3/8” x 3-1/2” long expansion bolts as recommended by the manufacturer. Use (4) bolts per mounting plate.
4. Height: Fabricate or job-cut height of brace tube to be no lower than 2” below knee-wall height.
5. Spacing: Install braces at 48” maximum within low stud walls and fasten one metal stud on each side of brace using self-tapping screws at nominal 6” centers vertically.

H. End-Wall Trim
1. Where indicated provide prefinished aluminum end-wall trim at walls terminating on window mullions.
2. Type: *Cased Jamb* RN303 with RN425 caps as manufactured by Raco Interior or approved equivalent. Sized for scheduled wall finish thickness.
3. Finish: Anodized to match window system mullions.

I. Preformed Aluminum Reveals – Provide at transition of VWC and painted drywall:
1. Type: 6063 T5 alloy extruded aluminum open reveal *Deco SG* as manufactured by Schluter or approved equivalent by Fry.
2. Size(s): Reveal size 5/8” deep x 1/2” high or as indicated in the drawings.
3. Finish: Clear anodized aluminum.

2.6 GYPSUM BOARD SHAFT WALLS

A. General:
1. Provide gypsum board shaft-wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.
2. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction

B. Intermittent Air-Pressure Loads: 5 lbf/sq. ft. (0.24 kPa).

C. Deflection Limit: L/240.

D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
1. Depth: As indicated.
2. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.

E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm), in depth matching studs.
1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.

F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76.2 mm), in depth matching studs, and not less than 0.0329 (0.84 mm) thick.

G. STC Rating: As indicated.

H. Cavity Insulation: Sound attenuation blankets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on drawings.

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. Suspend overhead framing from structural members or floor slabs only; do not suspend members from steel roof decks.

B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. Metal Stud Installation:
   1. Install studs in accordance with ASTM C754.
   2. Metal Stud Spacing: 16 inches on center.
      a. Install studs 12 inches on center behind wall tile and elsewhere where indicated.
   3. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Install deflection track at tops of walls to avoid axial loading.
   4. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
   5. Do not bridge building expansion joints with framing or furring members. Frame both sides of joints independently.
   6. Door Opening Framing: Install double studs at door frame jambs.
   7. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, and other wall-mounted items.
   8. Where studs are installed directly against exterior walls, install asphalt-saturated felt isolation strip between studs and wall.

B. Curved Partitions:
   1. Frame curved partitions to comply with GA-226 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated.
   2. Cut top and bottom tracks through leg and web at 2 inch intervals for arc length. In cutting lengths of track, allow for uncut straight lengths of not less than 12 inches at ends of arcs.
   3. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   4. Support outside (cut) leg of track by clinching steel sheet strip, 1-inch high-by-thickness of track metal, to inside of cut legs using metal lock fasteners.

5. Begin and end each arc with a stud, and space intermediate studs equally along arcs at stud spacing recommended in writing by gypsum board manufacturer for radii indicated. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

C. Suspended Framing Installation:
1. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
2. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
3. Suspend hangers from building structure as follows:
   a. 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.
   b. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   c. 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.
4. 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.
5. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
6. Do not attach hangers or suspend members from steel roof deck.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
9. Laterally brace entire suspension system.
10. Grid Suspension Systems:
    a. Install grid suspension system in accordance with manufacturer’s instructions
    b. Attach perimeter edge angle where ceiling system meets vertical surfaces
    c. Mechanically join main beam and cross furring members to each other and butt-cut to fit into wall track.

D. Exterior Soffit Framing Installation:
1. Install in accordance with ASTM C754.
2. Coordinate location of hangers with other work.
3. Install soffit framing independent of walls, columns, and above soffit work.
4. Reinforce openings in suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
5. Do not attach hangers to steel deck tabs.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
8. Brace system to resist lateral loads and wind uplift. Provide cross-bracing and additional framing required to resist wind uplift for design loads of 20 psf inward and outward.

E. Interior Ceiling Framing Installation:
1. Install grid suspension system in accordance with manufacturer’s instructions.
2. Laterally brace entire suspension system to building structure.
3. Install acoustic sealant between tops of partitions and bottom of ceiling board.

F. Gypsum Board Installation:

1. Install gypsum board in accordance with ASTM C840.
2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   a. At fire-rated partitions, erect single layer gypsum board vertically, with edges and ends occurring over firm bearing.
3. Double Layer Applications: Place second layer parallel with first layer. Offset joints of second layer from joints of first layer. Stagger joints on opposite sides of partition.
4. Cover both faces of stud framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
5. Erect ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
6. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and manufacturer's instructions for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
7. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
8. Install acoustic sealant where indicated.
9. Seal penetrations of partitions by conduit, pipe, duct work, rough-in boxes, and.
10. Erect glass mat gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
11. Use screws when fastening gypsum board to metal furring or framing.
12. Place control joints consistent with lines of building spaces as indicated on Drawings. as directed.
13. Place corner beads at external corners as indicated on Drawings. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
14. Install cementitious backer board in the following locations:
    a. Shower walls.
    b. Rear and side walls (wet walls) adjacent to lavatories, toilets, and urinals.
15. Install moisture resistant gypsum board in the following locations:
    a. Behind wall tile.
    b. Toilet room walls not receiving cementitious backer board.
16. Install abuse resistant gypsum board in corridors within 4 feet of floor.
17. Apply gypsum board to curved walls in accordance with GA-216.

G. Joint Treatment:
1. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
2. Feather coats on to adjoining surfaces so that camber is maximum 1/32 inch.
3. Finish cementitious backer board in accordance with manufacturer’s instructions.

H. Shaft Wall Assemblies
1. Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 for installing steel framing.
2. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
3. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312 inch (0.79 mm) minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
4. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection

behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

5. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
6. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.
7. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 2 inches (51 mm) of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2 or 5/8 inch (12.7 or 15.9 mm) thick, gypsum board cants covering tops of projections.
    a. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft-wall framing.
    b. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to the shaft-wall framing.

I. Marking of Fire Rated and Smoke Stop Partitions: All fire-rated partitions, smoke stop partitions, horizontal exit enclosures, and fire walls must be permanently marked above ceilings as follows: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS". Letters shall be minimum 2 1/2" in height and painted red. Provide one time per structural bay.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet.

3.5 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect shall conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

B. Notify Architect seven days in advance of date and time when Project, or part of Project, is to be ready for above-ceiling observation.

C. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
1. Installation of 80 percent of lighting fixtures, powered for operation.
2. Installation, insulation, and leak and pressure testing of water piping systems.
3. Installation of air-duct systems.
4. Installation of air devices.
5. Installation of mechanical system control-air tubing.
6. Installation of ceiling support framing.

3.6 SCHEDULES

A. Finishes in accordance with GA-214 Level:

1. **Level 1:** Embed tape at joints in ceiling plenum areas, concealed areas, on portions of walls above ceilings between the ceilings and the tops of walls and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.

2. **Level 2:** Embed tape and apply first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile.

3. **Level 3:** Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where panels are substrate for medium or heavy textures or heavy-grade wallcoverings. Verify with wallcovering installer that gypsum board finish is acceptable for wallcovering application.

4. **Level 4** (Standard Finish): Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges where panels are substrate for light textures, flat paints, or standard vinyl wallcoverings.

5. **Level 5:** Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where panels are substrate for gloss or semi-gloss paints.
   a. Provide at drywall panels in high-level natural or artificial lighting areas such as near glazed entries, clerestory windows, or down-lighting mounted on or near walls.
   b. Provide at drywall panels scheduled to receive dry-erase coatings or wall coverings to be used as dry-erase marker surfaces.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Ceramic wall tile and floor tile.
2. Quarry tile floor and base.
3. Marble thresholds at restroom entries.
4. Control joints in accordance with TCNA standards and recommendations.

B. Related Sections:
1. Section 01 23 00 – Alternates: Terrazzo as alternative floor finish at corridors as indicated.
2. Section 03 30 00 - Cast-In-Place Concrete: Troweling of floor slab for tile application.
3. Section 07 13 00 – Sheet Waterproofing.
4. Section 07 90 00 - Joint Protection.
5. Section 09 21 16 - Gypsum Board Assemblies: Moisture resistant gypsum board and cementitious backer board for wall tile application.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A108.1 - Installation of Ceramic Tile, A collection.
2. ANSI A108.1A - Specifications for Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar.
3. ANSI A108.1B - Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
4. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar -or- Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
5. ANSI A108.5 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
6. ANSI A108.9 - Specifications for Ceramic Tile Installed with Modified Epoxy Emulsion Mortar/Grout.
7. ANSI A108.10 - Specifications for Installation of Grout in Tilework.
8. ANSI A118.1 - Standard Specification for Dry-Set Portland Cement Mortar.
9. ANSI A118.4 – Modified Dry-Set Cement Mortar.
10. ANSI A118.6 - Ceramic Tile Grouts.
11. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
12. ANSI A118.15 – Improved Modified Dry-Set Cement Mortar
13. ANSI A137.1 - Ceramic Tile.

B. Tile Council of North America:
1. TCNA - Handbook for Ceramic Tile Installation.

C. International Standard Organization:
1. ISO 13007 – Standards for Ceramic Tiles, Grouts, and Adhesives.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, and setting details.

C. Product Data: Submit instructions for using grouts and adhesives.

D. Samples:

1. For each type and color of tile specified, submit mounted tile and grout on two plywood panels, at least 12 x 12 inch in size, illustrating pattern, color variations, and grout joint size variations.
2. Submit 2 full-size units of each trim and accessory.
3. Submit stone thresholds in 6 inch lengths.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with TCNA Handbook and ANSI A108 Series/A118 Series.

B. Install glass tile in accordance with tile manufacturer's instructions.

C. To ensure warranty requirements and compatibility of products provide all tile grout, setting materials, additives, accessories, and factory-prepared dry-set mortars from the same manufacturer.

D. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years' experience.

E. Installer: Company specializing in performing Work of this section with minimum three years' experience, approved by tile manufacturer, and a member of the National Tile Contractors Association of America.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect adhesives and grouts from freezing or overheating.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install adhesives and grouts in unventilated environment.

C. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 TILE

A. Tile Manufacturers: Refer to specific manufacturers and products indicated in the Drawings

to determine the Project requirements. Subject to compliance with requirements, provide products indicated or equal product by one of the following manufacturers.

1. Acceptance of products other than those indicated is contingent upon submittal of proposed alternate products to the Architect. Submittal of proposed alternate products must occur prior to bidding as described in Division One specification section “Product Substitutions”.

2. Submittals must demonstrate to the Architect that the proposed alternate product line has colors that match the basis-of-design indicated. The Architect may reject the proposed product for technical non-compliance or, at his discretion, on the basis of the color match alone.

B. Manufacturers:
   1. American Marazzi Tile, Inc.
   2. American Olean; Div. of Dal-Tile International Corp.
   3. American Tile Supply.
   4. Concept Surfaces, LLC
   5. Crossville Ceramics Company, L.P.
   6. Daltile; Div. of Dal-Tile International Inc.
   7. Emser Tile, LLC
   8. Monarch Tile, Inc.
   9. Summitville Tiles, Inc.
   10. United States Ceramic Tile Company.
   11. Additional manufacturers as may be listed in the Finish/Color Schedule
   12. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Ceramic Mosaic Floor Tile: ANSI A137.1, conforming to the following:
   1. Basis of Design: As scheduled.
   2. Moisture Absorption: 0 to 0.5 percent.
   3. Base: 5” high (2-1/2 tiles) matching base, coved and flush with both floor and wall tile.
   4. Surface Finish: Unglazed.
   5. Joint Width: As scheduled.
   6. Use latex-Portland cement grout, sanded or unsanded depending on joint size below.

B. Porcelain Floor Tile: ANSI A137.1, conforming to the following:
   1. Basis of Design: As scheduled, both standard and large format.
   2. Moisture Absorption: 0 to 0.5 percent.
   3. Base: Matching base, coved when available from the manufacturer. Flush with floor and wall tile.
   4. Surface Finish: Unglazed.
   5. Joint Width: As scheduled.
   6. Use latex-Portland cement grout, sanded or unsanded depending on joint size below.

C. Ceramic Wall Tile: ANSI A137.1, conforming to the following:
   1. Basis of Design: As scheduled.
   2. Moisture Absorption: 0 to 0.5 percent.
   3. Surface Finish: Glazed as scheduled.
   4. Joint Width: As scheduled.
   5. Use latex-Portland cement grout, sanded or unsanded depending on joint size below.
   6. Base: As scheduled.

D. Quarry Tile: ANSI A137.1, conforming to the following:
   1. Basis of Design: As scheduled.
   2. Moisture Absorption: 0.5 to 3.0 percent.
   3. Size: Nominal 6” x 6” x 1/2”.
   4. Shape: Square.
   5. Edge: Square.

6. Surface Finish: Unglazed, smooth
7. Joint Width: Uniform, 1/4” maximum.
8. Base:
   a. Size: 6” high x 6” long.
   b. Top Edge: Bullnose.
   c. Toe: Cove flush with floor tile.
9. Use epoxy emulsion grout.

2.3 ACCESSORIES

A. Mortar Materials:
   1. Manufacturers:
      a. Ardex Americas, www.ardexamericas.com
      b. Bonsal, W. R., Company
      c. Bostik www.bostik.com/bostikusa.html
      d. C-Cure Corporation www.c-cure.com
      e. Laticrete International, Inc. www.laticrete.com
      f. Mapei Corporation www.mapei.com
      g. TEC Specialty Products Inc.
      h. Substitutions: Section 01 60 00 - Product Requirements.

   2. Mortar Bed Materials at Recessed Slabs: ANSI A108.1A; Portland cement, sand, latex additive, and water; proportioned in accordance with TCNA specifications.

   3. Mortar Bond Coat Materials:
      a. General: Latex-Portland Cement single-component type polymer-modified thin-set or medium bed mortar.
      b. Basis of Design:

         1) For Small Format Floor or Wall Tile (all dimensions less than 15”): *Ultraflex-2* thin-set as manufactured by Mapei or approved equivalent by specified manufacturer; meets or exceeds requirements of ANSI A118.4E, ANSI A118.11, and ISO C2TE.

         2) For Large Format Floor Tile (any dimension 15” or greater): *Ultraflex-LFT* medium bed as manufactured by Mapei or approved equivalent by specified manufacturer; meets or exceeds requirements of ANSI A118.4, ISO 13007 C2TES1P1, and TE and ANSI A118.11.

         3) For Large Format Wall Tile (any dimension 12” or greater): *Ultralite Pro* non-sag type as manufactured by Mapei or approved equivalent by specified manufacturer; meets or exceeds requirements of ANSI A118.4TE, ANSI A118.4TE, and ISO 13007 C2TE.

B. Grout Materials:
   1. Manufacturers:
      a. Ardex Americas, www.ardexamericas.com
      b. Bonsal, W. R., Company
      c. Bostik www.bostik.com/bostikusa.html
      d. C-Cure Corporation www.c-cure.com
      e. Laticrete International, Inc. www.laticrete.com
      f. Mapei Corporation www.mapei.com
      g. TEC Specialty Products Inc.
      h. Texrite www.texrite.com
      i. Substitutions: Section 01 60 00 - Product Requirements.

   2. Sanded Grout: Calcium Aluminate Cement type that meets or exceeds requirements of ANSI A118.6.
      a. Color: As selected.

b. Basis of Design: *Ultracolor Plus FA* as manufactured by Mapei or approved equivalent by specified manufacturer.
c. Application: For non-epoxy joints 1/16” or greater.
d. Use acid-resistant grout at restrooms, unless indicated as epoxy.

3. Non-Sanded Grout: Latex-Portland cement polymer-modified type that meets or exceeds requirements of ANSI A118.6.
   a. Color: As selected.
   b. Basis of Design: *Keracolor-U* as manufactured by Mapei or approved equivalent by specified manufacturer.
   c. Application: For non-epoxy joints less than 1/16”.
   d. Use acid-resistant grout at restrooms, unless indicated as epoxy.

4. Epoxy Grout: 100% solids, chemical-resistant, industrial-grade modified epoxy grout suitable for use in commercial kitchens; Meets or exceeds requirements of ANSI A118.3.
   a. Color(s) as selected.
   b. Basis of Design: *Kerapoxy-IEG CQ* as manufactured by Mapei or approved equivalent by specified manufacturer.
   c. Application: Use for quarry tile applications and where specifically indicated.

C. Waterproofing Membrane at showers: Not applicable.

D. Reinforcing Mesh: 2 x 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

E. Crack Control Membrane: At substrate cracking and construction/expansion joints in dry areas, provide liquid-applied or sheet membrane meeting or exceeding requirements of ASTM C627. Use with reinforcing fabric:

1. For Covering Shrinkage Cracking and Non-Structural Cracks to less than 1/8” - Use one of the following:
   a. *Mapelastic C1* as manufactured by MAPEI: Liquid-applied.
   b. *Blue 92* as manufactured by Laticrete: Liquid-applied.
   c. *Mapeguard 2 with SM Primer* as manufactured by MAPEI: Sheet
   d. *NobleSeal CIS* as manufactured by Noble Corp: Sheet.
2. For Bridging Construction Joints and Any Cracks 1/8” or greater– Use one of the following membrane sheets meeting or exceeding requirements of ASTM C627-*Extra Heavy*:
   a. *Mapeguard 2 with SM Primer* as manufactured by MAPEI.
   b. *Crack Isolation Mat* as manufactured by Laticrete.
   c. *NobleSeal CIS* as manufactured by Noble Corp.
   d. In addition install sealant-filled control joint at or within 12” of construction joints or any joints exceeding 1/4” in width.

F. Cementitious Backer Board: As specified in Section 09 21 16 for use at shower walls.

G. Marble Thresholds: Provide at each entry door or framed opening to restrooms or restroom vestibules.

1. Material: Carrara white marble, Grade A.
2. Configuration: One-piece material, 2-in. wide x full width of door. ADA compliant with long edges beveled and top surface of threshold 3/8” – 1/2” higher than finish flooring on either side.

3. Finish: Sealed with clear non-yellowing penetrating sealer.

4. Location:
    a. Door: Center threshold on door.
    b. Opening without door: Center on wall opening or frame.

H. Trowelable Underlayments and Patching Compounds: Latex-modified cementitious type, Planiprep SC as manufactured by MAPEI Corporation or approved equivalent by ARDEX Engineered Cements.

I. Finished Metal Accessories: Unless scheduled otherwise, furnish decorative metal edge strips, transition strips, and corners and trim with integral provision for anchorage to mortar bed or substrate at all exposed tile edges.
1. Manufacturers:
    a. Schluter-Rondec, www.schluter.com.
    b. Substitutions: Section 01 60 00 - Product Requirements.

2. Transition Strips – Typical:
    a. Tile to Concrete, VCT, Rubber, or Linoleum: Schluter-RENO-U, aluminum.
    b. Tile to Carpet: Schluter-RENO-TK, aluminum
    c. Top of Wainscot Edge Strip: Schluter-Rondec, extruded clear satin anodized aluminum. Provide manufacturer's factory-formed matching fittings at tee-intersections.

3. Coved Tile-to-Tile Transition Strips – Where Scheduled:
    a. Tile Floor to Tile Wall: Schluter-DILEX-HKS stainless steel cove with flanges. Typically for no-base situations. Reference the Finish Schedule.
    b. Vertical Inside Corner - Tile Wall to Tile Wall: Schluter-DILEX-EHK stainless steel cove with flanges. Reference the Finish Schedule.

4. Vertical Outside Corners
    a. Tile to Tile: Schluter-Rondec or as indicated, extruded clear satin anodized aluminum.
    b. Bullnose Tile: Where specifically indicated provide matching tiles with bullnose edge for corners in lieu of metal edge strips.

J. Steel Reinforcing Mesh: 2 x 2 inch size weave of 16/16 wire size, galvanized welded fabric for mortar beds.

K. 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.

1. MAPEI *Ultracare Stone, Tile & Grout Care* Solutions or approved equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive work.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Mix and install leveling and patching compound in accordance with underlayment manufacturer's printed instructions. Fill low spots and grind high spots to bring floor to level.

D. Install crack control membrane at substrate cracking and construction/expansion joints in accordance with membrane manufacturer's printed recommendations.

E. Prepare surfaces and install in strict accordance with waterproofing membrane manufacturer's printed recommendations

F. Seal substrate surface cracks with filler.

G. Prepare substrate surfaces for adhesive installation.

3.3 INSTALLATION

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCNA Handbook recommendations.

B. Lay tile to patterns indicated. Do not interrupt tile pattern through openings.

C. Place metal edge strips at exposed tile edges.

D. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.

E. Joints: Place tile with joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout. Notify Architect in advance of setting tile whether conditions of tile or substrate will negatively affect appearance or performance of the following specified joint widths:
   1. Ceramic or Porcelain Floor or Wall Tile:
      a. 1" x 1" to 4" x 4" Tile: 1/16-inch.
      b. 6" x 6" to 12" x 12" Tile: 1/8-inch.
      c. Large Format Tile, Rectified: 3/16-inch.
      d. Large Format Tile, Non-Rectified: 1/4 inch – 3/8 inch.
   2. Glass Wall Tile: 1/16 inch.
   3. Quarry Tile: 1/4 inch - 3/8 inch.

F. Control Joints: Locate sealant-filled control joints in accordance with TCNA standards and recommendations and the approved shop drawings. Pay special attention to areas where large temperature variations may occur on the flooring, such as at glazed entry or windowed areas.

G. Form internal angles square and external angles bullnosed.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control joints free of adhesive or grout. Apply sealant to joints.

J. Allow tile to set for a minimum of 48 hours prior to grouting.

K. Grout tile joints.

L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

M. Installation - Floors - Thin-Set or Medium Bed Methods:
   1. Over interior concrete slabs, install with latex-Portland cement grout in accordance with TCNA Handbook Method F113-14 for slabs-on-grade and A113A-14 for slabs-above-ground:
      a. Where waterproofing membrane is indicated, install in accordance with TCNA Handbook Method F122, with latex-Portland cement grout.

N. Installation - Floors - Mortar Bed Methods at Recessed Slabs:
   1. Over interior concrete slabs, install in accordance with TCNA Handbook Method F112, bonded, with latex-Portland cement grout.
      a. Where waterproofing membrane is indicated, install in accordance with TCNA Handbook Method F121, with latex-Portland cement grout.

b. Where quarry tile is indicated, install in accordance with TCNA Handbook Method F112, with epoxy grout.

O. Installation - Wall Tile:
1. Over cementitious backer units install in accordance with TCNA Handbook Method W244, with Portland-cement grout.
2. Over moisture-resistant gypsum wallboard, install in accordance with TCNA Handbook Method W243, with latex-Portland cement grout.
3. Over concrete masonry, install in accordance with TCNA Handbook Method W202, with Portland cement grout.

P. Stone Thresholds: Install where edge of tile flooring is exposed in wet area such as showers.

Q. Metal Edge Strips:
1. Install floor transition strips at all floor tile terminations where stone thresholds are not installed.
2. Install wall edge strips at exposed edges of tile where wall tile terminates away from inside corners.

R. Install waterproofing membranes as specified in Section 07 13 00.

S. When bonding large-format tiles, install in accordance with TCNA and tile manufacturer's recommendations to achieve full coverage of mortar bed under tile surface. Back-butter tiles as necessary to ensure full coverage.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean tile and grout surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Do not permit traffic over finished floor surface for 4 days after installation.

C. Keep epoxy grout free of construction drywall dust until fully cured, as determined by the epoxy grout manufacturer.

END OF SECTION

SECTION 09 51 13 – LAY-IN ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Section includes acoustical ceiling panels in suspended grid.
   2. Section includes special perimeter trim at ceiling panel clouds.

B. Related Work:
   1. Section 09 54 23 – Linear Metal Ceilings.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   4. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   5. ASTM E580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
   6. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

B. Ceilings and Interior Systems Construction Association:
   1. CISCA - Acoustical Ceilings: Use and Practice.

C. Underwriters Laboratories Inc.:
   1. UL - Fire Resistance Directory.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling suspension system members.
   2. Method of attaching suspension system hangers to building structure.
   3. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinklers; and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
   4. Minimum Drawing Scale: 1/8 inch = 1 foot (1:96).

C. Product Data: Submit data on acoustic units, metal grid system components, and edge trim.

D. Samples:
   1. Submit two samples, 6 x 6 inch in size, of each type of acoustic panel specified.
   2. Submit two samples, 12 inches long, of each type of exposed suspension system specified.

E. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

F. Certification: Provide certification from manufacturer of products that all materials used in food preparation and food serving areas have USDA approval for use in food preparation and food serving areas.

1.4 QUALITY ASSURANCE

A. Conform to CISCA requirements.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Certify all materials used in food preparation and food serving areas have USDA approval for use in food serving and food preparation areas.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum three years' experience and approved by manufacturer.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

1.8 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat or air conditioning is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install acoustic units after interior wet work is dry.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish 2 percent of total acoustic unit area of extra panels to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ceiling Panels
1. Armstrong World Industries, Inc., www.armstrong.com
2. CertainTeed/Saint Gobain, www.certainteed.com
3. USG Interiors, Inc., www.usg.com
4. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Suspension Grid
1. Armstrong World Industries, Inc., www.armstrong.com
2. BPB America.
3. CertainTeed/Saint Gobain, www.certainteed.com
4. Chicago Metallic Corporation, www.chicagometallic.net

5. USG Interiors, Inc., www.usg.com
6. Substitutions: Section 01 25 00 – Substitution Procedures.

2.2 COMPONENTS

A. **APC-1**: ASTM E1264, Type IV conforming to the following:
1. Basis of Design: *Fine Fissured* as manufactured by Armstrong or approved equivalent by specified manufacturer.
2. Size: 24 x 24 inches.
3. Thickness: 5/8 inches.
4. Composition: Mineral fiber, wet-formed.
5. Light Reflectance Coefficient: 0.85.
6. NRC: 0.55.
7. CAC: 35.
8. Edge: Square.
9. Surface Color: White, typical.
10. Surface Finish: Fine texture, no pattern.
11. Special Treatment: *HumiGuard Plus* and *BioBlock+.*
12. Grid: Factory 15/16” wide white.

B. **APC-2**: ASTM E1264, Type IV, conforming to the following:
1. Basis of Design: *Ultima Health Zone* as manufactured by Armstrong or approved equivalent by specified manufacturer.
2. Size: 24 x 24 inches.
3. Thickness: 3/4 inches.
4. Composition: Mineral fiber, wet-formed.
5. Light Reflectance Coefficient: 0.86.
6. NRC: 0.70
7. CAC: 38.
8. Edge: Square.
9. Surface Color: White.
10. Surface Finish: Smooth-textured, unperforated, washable vinyl-face.
11. Special Treatment: *HumiGuard Plus* and *BioBlock+.*
12. Grid: Factory 15/16” wide factory white aluminum cap on steel.

C. **APC-3**: Acoustic Panels conforming to ASTM E1264, conforming to the following:
1. Basis of Design: *Fine Fissured* as manufactured by Armstrong or approved equivalent by specified manufacturer.
2. Size: 24 x 24 inches.
3. Thickness: 5/8 inches.
4. Composition: Mineral.
5. NRC: 0.55.
6. CAC: 33.
7. Edge: Square.
8. Surface Color: Tech Black.
9. Special Treatment: *HumiGuard Plus* and *BioBlock+.*
10. Grid: Factory 15/16” wide black.

D. **APC-4**: Acoustic Panels conforming to ASTM E1264, conforming to the following:
1. Basis of Design: *Fine Fissured High NRC* as manufactured by Armstrong or approved equivalent by specified manufacturer.
2. Size: 24 x 24 inches.
3. Thickness: 7/8 inches.
4. Composition: Mineral fiber, wet formed.
5. Light Reflectiance Coefficient: 0.85
6. NRC: 0.75.
7. CAC: 35.
8. Edge: Square.
9. Surface Color: White, typical.

10. Surface Finish: Fine texture, no pattern.
11. Special Treatment: *HumiGuard Plus* and *BioBlock+.*
12. Grid: Factory 15/16” wide factory white aluminum cap on steel.

E. Grid:
1. Non-fire Rated Grid: ASTM C635, intermediate duty; exposed T; components die cut and interlocking.
2. Grid Materials: Commercial quality cold rolled steel with galvanized coating.
   a. Basis of design, *Prelude XL* as manufactured by Armstrong or approved equivalent by specified manufacturer.
   b. Grid Finish:
      1) Ceiling Panels **APC-1, APC-4**: Factory painted white.
      2) Ceiling Panels **APC-2**: Factory white painted aluminum cap over galvanized steel grid. Provide at all wet areas such as restrooms, custodial, or foodservice in all buildings.
      3) Ceiling Panels **APC-3**: Factory painted black.
3. Accessories: Stabilizer bars, clips, splices, perimeter moldings, hold down clips, and other items required for suspended grid system.
   a. For circular penetrations of ceiling, provide perimeter moldings fabricated to diameter required to fit penetration exactly.
4. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
   a. Post-installed Powder-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 per ASTM E 1190, conducted by a qualified testing and inspecting agency.
   b. Zinc-Coated Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper. Select wire diameter so its stress at three times hanger design load will be less than yield stress of wire but provide not less than 0.106 inch diameter wire.

F. Special Perimeter Trim:
1. Extruded aluminum perimeter trim for framing ceiling clouds; square profile, white painted finish to match grid. Sizes as indicated in the drawings.
2. Basis of Design*: Axiom Classic Trim* as manufactured by Armstrong or approved equivalent by specified grid manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify layout of hangers will not interfere with other work.

3.2 EXISTING WORK

A. Extend existing acoustical ceiling installations using materials and methods as specified.

B. Clean and repair existing acoustical ceilings which remain or are to be reinstalled.

3.3 INSTALLATION

A. Lay-In Grid Suspension System:
1. Install suspension system in accordance with ASTM C635, ASTM C636 and as supplemented in this section.
2. Install system capable of supporting imposed loads to deflection of 1/360 maximum.

3. Lay out system to balanced grid design with edge units no less than 50 percent of acoustic unit size.
4. Install after major above ceiling work is complete. Coordinate location of hangers with other work.
5. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, and provide hangers not more than 8 inches from ends of each member.
8. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.
9. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
10. Do not eccentrically load system, or produce rotation of runners.
11. Perimeter Molding:
    a. Install edge molding at intersection of ceiling and vertical surfaces.
    b. Use longest practical lengths.
    c. Overlap corners.
    d. Do not use exposed fasteners, including pop rivets, on moldings and trim.
    e. Install at junctions with other interruptions.

B. Acoustic Units:
1. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
2. Fit border trim neatly against abutting surfaces.
3. Install units after above-ceiling work is complete.
4. Install acoustic units level, in uniform plane, and free from twist, warp, and dents.
5. Cut to fit irregular grid and perimeter edge trim.
6. Where round obstructions occur, install preformed closures to match perimeter molding.
7. Install hold-down clips to retain panels tight to grid system within 20 ft of exterior door.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 54 23 – LINEAR METAL CEILING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Suspended decorative interior linear metal ceilings with factory perforations.

B. Related Sections include the following:
   1. Section 09 51 13 – Lay-In Acoustical Panel Ceilings: For interior ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension grid systems.
   2. Division 21 Sections for fire protection systems.
   3. Division 23 Sections for grilles, registers, and diffusers.
   4. Division 26 Sections for light fixtures.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   2. ASTM C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   3. ASTM E580 - Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

B. Ceilings and Interior Systems Construction Association:
   1. CISCA - Acoustical Ceilings: Use and Practice.

1.3 SUBMITTALS

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

B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
   1. Ceiling pattern.
   2. Ceiling suspension members.
   3. Indicate all required end joints in panel lengths.
   4. Ceiling-mounted or above-ceiling items including lighting fixtures, air outlets and inlets; speakers; sprinklers; access panels, column penetrations, and any other junctures, penetrations, or interfaces with specialty metal ceilings.
   5. Submit details indicating special conditions.

C. 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.

D. Physical Samples: Submit (2) 12” lengths of factory-finished sections, (2) 12” lengths of factory-finished support grid, and (2) 12” lengths of matching ceiling-penetration trim.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed specialty metal ceilings similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Specialty Metal Ceilings: Obtain specialty metal ceilings from one source with resources to provide products of consistent quality in appearance and physical properties.

C. Fire-Test-Response Characteristics: Provide specialty metal ceiling components with the following surface-burning characteristics as determined by testing identical assemblies per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify ceiling units with appropriate markings of applicable testing and inspecting agency.
   1. Flame Spread: 25 or less.
   2. Smoke Developed: 50 or less.

D. Mockups: Prior to installing specialty metal ceilings, construct mockups for each form of construction and finish required to verify selections made under Sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mockups shall be built by the Subcontractor responsible for the Project Work. Build mockups to comply with the following requirements, using all conditions and materials indicated for the completed Work:
   1. Build mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Erect mockups 10’ by 10’ (3 m by 3 m) using materials indicated for final Work.
   3. Notify Architect 7 days in advance of dates and times when mockups will be constructed.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before beginning final installation of specialty metal ceilings.
   6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work. Approved mockups may be incorporated into the final installation.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the Project site in the original, labeled, unopened packages.

B. Materials shall be stored off of the floor level, flat and level, in a fully enclosed space.

C. Exercise care in handling to avoid damage.

1.7 PROJECT CONDITIONS

A. Do not install specialty metal 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.

1.8 COORDINATION

A. Coordinate layout and installation of specialty metal panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.9 WARRANTY

A. Installed suspension system and ceiling panels shall be warranted by Contractor to be free from rusting, sagging, warping, shrinking, buckling, or delaminating for a minimum of one year from date of Substantial Completion of the Project.

B. For sag-resistant panels, provide ceiling panel manufacturer's written warranty against sagging, warping, shrinking, buckling or delaminating as a result of manufacturing defects for a period of ten years from date of Substantial Completion of the Project.

C. Provide suspension manufacturer's written warranty against material defects for a period of fifteen years from date of Substantial Completion.

1. Where suspension manufacturer and non-sag ceiling panel manufacturer are the same, provide combination warranty including protection from sagging, warping, shrinking, buckling or delaminating of ceiling panels as a result of manufacturing defects.

D. Provide suspension manufacturer's written warranty against the occurrence of 50% red rust on grid face for a period of thirty years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Specialty Metal Ceiling Units: Full-length units equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong World Industries, Inc, www.armstrongceilings.com
B. Hunter-Douglass Architectural Products, Inc., www.hunterdouglas.com
C. Reference Section 01 25 13-Product Substitutions.

2.2 SYSTEM AND COMPONENTS:

A. Type **APC-5** as indicated on the drawings**:** Interior Perforated Metal Panels: ASTM E 84, with flame spread less than 25 and smokedeveloped 50 or less. Class A per ASTM E1264. For all interior locations.

B. Basis of Design: *MetalWorks Linear Ceiling System* as manufactured by Armstrong, or approved equivalent by specified manufacturer.
1. Panel Width: Nominal 6" including 1" reveal.
2. Material: Factory-finished electro-galvanized formed steel sheet.
3. Finish: Factory powder coat finish. Color/pattern selected from manufacturer's standard line of faux wood finishes as indicated in Finish Schedule.
   a. Edges: *Tegular Vector Linear* long edges: Square with extended flange covered with manufacturer's black color filler strip, item #5494 creating auniform nominal 1-inch reveal.
4. Splicing System: Manufacturer's 6" long back-mounted panel splice provding hairline joint between panel ends.
   a. Provide cross joints only where length of installed panels exceeds manufacturer's available panel lengths.
   b. Stagger cross joints uniformly a minimum of 12" between adjacent panels.
5. Options Provided:

a. Perforations: Manufacturer's *M1Microperforated* face.
b. Acoustical: Manufacturer's black poly-encapsulated fiberglass infill to provide an NRC of nominal 0.70.

C. Suspension System:
1. Non-fire Rated Grid: ASTM C635, 15/16" face, galvanized, intermediate duty; modified as indicated below; components die cut and interlocking.
a. Commercial quality cold rolled steel with galvanized coating.
b. Wire-suspended main beam carriers with 4 ft. drywall grid cross tee stabilizers.
c. Manufacturer's linear "J" clip system attached to face of main beam carriers for suspending turned long edges of panels: *Metalworks Linear Carrier*.
2. Screw-fastener or powder-actuated fastening system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for system with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
3. Zinc-Coated Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper. Select wire diameter so its stress at three times hanger design load will be less than yield stress of wire but provide not less than 0.106 inch diameter wire.

2.5 FINISHES, GENERAL

A. Protect the specified finish on exposed surfaces by applying 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 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine overhead construction prior to beginning installation of specialty metal ceilings to ensure that all overhead work including finish painting of deck, structure, ducting, conduits, piping, etc. is completed.

B. Proceed with installation only after unsatisfactory conditions have been corrected. Beginning of specialty ceiling installation indicates acceptance of overhead work.

C. Verify layout of hangers will not interfere with other work.

3.3 INSTALLATION

A. General: Install specialty metal ceilings in accordance with manufacturer's recommendations and requirements and to comply with the following:
1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
2. CISCA Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. Space main tees and cross tees no more than 48" o.c.

B. Install system capable of supporting imposed loads to deflection of 1/360 maximum.

C. Suspend ceiling hangers from building's structural members and as follows:
   1. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system.
   3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
   5. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for structure to which hangers are attached and for 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, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
   7. Do not attach hangers to steel deck tabs.
   8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated.

D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs.
   1. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
   2. Bracing wires shall be located as to not be visible from below ceiling.

E. Install suspension system carriers so they are aligned and securely interlocked with one another. Remove and replace dented, deformed, or kinked members

F. Neatly cut finished units for accurate fit at interruptions and penetrations through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

G. Install finished units in coordination with suspension system and exposed moldings and trim.
   1. Where finished length exceeds manufacturer’s standard lengths, fit adjoining units to form flush, tight joints.
   2. Install panels with butt joints using internal panel splices and in aligned configuration.
   3. Install directionally textured panels in directions indicated.
   4. Install matching end caps at open ends of finished units.
   5. Do not use exposed fasteners, including pop rivets, on moldings and trim.

3.4 CLEANING

A. Clean exposed surfaces of specialty metal ceilings, including visible support framing. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and deformed units.

END OF SECTION

SECTION 09 64 13 – FINSH WOOD STAGE STEPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes site finished wood stage steps, including treads and risers:
   1. Installation of vapor retarder, sleepers and subflooring for Red Oak flooring at stage/platform.
   2. Sanding and finishing of Red Oak stage trim, base, treads, and risers to match stage/platform flooring.

B. Related Sections:
   1. Section 06 20 24 - Interior Finish Carpentry and Millwork: Subflooring construction for finish treads and risers..
   2. Division 09 65 00 – Resilient Flooring: Vinyl tile and rubber base at stage behind curtain line.

1.2 REFERENCES

A. APA-The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

B. ASTM International:
   1. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
   2. ASTM F2170 testing. Standard Test Methods for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes.

C. National Oak Flooring Manufacturers Association:
   1. NOFMA 24 - Installing Hardwood Flooring - Strip, Plank & Parquet.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate installation details, including location and layout of each accessory.

C. Product Data: Submit data for each flooring and floor finish material.

D. Samples: Submit 24” x 24” samples panel of wood flooring, illustrating full range of color and texture variations.

E. Manufacturer's Installation Instructions: Submit standard and special installation procedures, and perimeter conditions requiring special attention. Include manufacturer's recommendations for accessory products.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, suggested schedule for cleaning, stripping, and re-finishing, stain removal methods, and polishes and waxes.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NOFMA 24 - National Oak Flooring Manufacturers Association.

B. Products: Stamp MFMA mill number and grade on underside of each piece of wood flooring at factory.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section with minimum three years' experience and approved by manufacturer.

1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install wood flooring materials until wet construction work is complete and ambient air at installation space has moisture content stabilized between 35 and 50 percent and temperature is stabilized between 65 and 80 degrees F.

C. Do not install wood flooring materials until wood materials have been acclimated to ambient temperature and humidity conditions for minimum of 72 hours. Stack wood for acclimation procedures to facilitate cross-ventilation of wood materials.

D. Provide heat, light, and ventilation prior to installation.

E. Maintain room temperature and humidity for period of two days prior to delivery of materials to installation space, during installation, and continuously after installation.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Wood Trim: Red Oak.
1. Grade: No. 1 Common.
2. Cut: Plain sawn.
3. Moisture Content: 12 to 14 percent.
4. Size: 25/32" x 2-1/4".
5. Profile: Tongue and groove edges, end-matched.
6. Lengths: Provide standard random-length strips complying with applicable grading rules, minimum 24".

B. Flooring Nails or Machine Staples: Type as recommended by the manufacturer and NOFMA; cement coated.

C. Sleepers and Shims: Softwood lumber, pressure treated for moisture protection, 2 x 4 inch size. Provide only Kiln Dried After Treatment (KDAT) material.
1. Provided under Finish Carpentry Section.

D. Subflooring: APA plywood, 3/4-inch thicknesses, with tongue and groove long edges.
1. Interior Composite Wood Products: Contain no added urea-formaldehyde resins.
2. Provided under Finish Carpentry Section.

E. Vapor Retarder: ASTM D 4397, clear polyethylene sheet not less than 6.0 mils thick. Provide where recommended by Oak flooring manufacturer.

2.2 ACCESSORIES

A. Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors;

compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

B. Floor Finish: Oil modified polyurethane, to achieve semi-gloss finish; type recommended by finish manufacturer for the specific application. Minimum 3-coats.

C. Floor Stain: Penetrating type recommended by flooring manufacturer.

D. Sealer: Pliable, penetrating type.

E. Wood Trim: In same species and grade as wood flooring, unless otherwise indicated.
   1. Oak Shoe Molding: 1/2 by 3/4 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet.

C. Verify that moisture content of the concrete slab does not exceed 85% RH per ASTM F 2170 testing.
   1. Perform deep-probe moisture meter testing per ASTM-F2170 for each area receiving the specified floor finish.
   2. Perform number of tests recommended by the flooring system manufacturer per each floor area, but no less than one test per each 1000 sq. ft.
   3. Provide written test results to the Architect, along with flooring manufacturer’s recommended maximum moisture values.

D. Verify required floor mounted utilities are in proper location.

E. Verify wood flooring has been acclimated to ambient temperatures, and acclimation and ambient temperatures are in accordance with flooring manufacturer’s instructions.

3.2 PREPARATION

A. Sleepers and Shims (provided under Finish Carpentry):
   1. Place vapor retarder over concrete subfloor, lapping edges and ends minimum 6 inches and tape seal.
   2. Place sleepers over vapor retarder; space sleepers at 12 inches oc.
   3. Shim underside of sleepers with layers of heavy sound deadening felt to achieve level line of plus or minus 1/4 inch in 10 feet.
   4. Anchor sleepers to concrete slab with powder actuated fasteners at 16-inch centers or closer.

B. Subflooring (provided under Finish Carpentry):
   1. Place plywood subflooring over sleepers.
   2. Install acoustic insulation blankets snug between wood sleepers.
   3. Lay one layer 3/4-inch thick plywood with long edge perpendicular to sleepers and end joints nominally centered on sleepers. Stagger end joints of adjacent panels minimum 24”.
   4. Screw-fasten with 2” flat head wood screws at 12-inch centers or closer along each sleeper.

C. Broom clean substrate.

3.3 INSTALLATION

A. Strip Flooring:
   1. Install in accordance with flooring manufacturer's instructions, and in accordance with NOFMA's "Installing Hardwood Flooring," as applicable to flooring type and location.

2. Blind-fasten to wood sub-floor.
3. Lay flooring parallel to width of stage. Verify alignment as work progresses.
4. Arrange flooring with end matched grain set flush and tight.
5. Install continuous matching bullnose Oak trim at tread nosings as indicated in the drawings.
6. Install matching Oak shoe molding at unprotected or exposed edges, and where treads and risers terminate at walls. Provide 3/4-inch expansion space at fixed walls and other interruptions and cover with Oak shoe molding.

B. Finishing Wood Treads and Risers:
1. Provide final finishing of all wood flooring and related items including base, shoe mold, treads and risers.
2. Fill open-grained hardwood. Fill and repair any open joints or other defects to Architect's satisfaction or remove and replace wood flooring in the affected area.
3. Mask off adjacent surfaces before beginning sanding.
4. Sand flooring, treads and risers to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
5. Apply filler and stain and three finish coats.
6. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with tack cloth before applying succeeding coat.
7. Each successive coat: Lightly buff between fully cured coats with steel wool, vacuum clean and wipe with tack cloth before applying succeeding coat.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on floor finish for minimum 48 hours after installation.

C. Maintain finish manufacturer's recommended temperature and humidity levels until finish is fully cured.

D. After drying of final finish, protect installed flooring with sheets of hardboard on kraft paper or double layer of sound-deadening felt with edges lapped and taped.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean finished strip floor surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 65 00 - RESILIENT FLOORING AND BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Solid Vinyl Tile flooring.
2. Final cleaning of all installed SVT.
3. Rubber base: Provide and install standard coved rubber base where scheduled throughout the project, regardless of floor finish.
4. Rubber stairs accessories

B. Related Sections
1. Section 03 30 00 – Cast-In-Place Concrete: Subfloor conditions.
2. Section 04 20 00 – Unit Masonry Assemblies: Wall conditions.
3. Section 09 21 16 – Gypsum Board Assemblies: Wall conditions.

1.2 REFERENCES

A. ASTM International:
1. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.
2. ASTM F1861 - Standard Specification for Resilient Wall Base.
3. ASTM F2169 - Standard Specification for Resilient Stair Treads.
4. ASTM F2170-11 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

B. International Organization for Standardization
1. ISO 10581 – International Standard for Resilient floor coverings, 2019

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples:
1. Submit manufacturer's complete set of color samples for initial selection.
2. Submit two full size samples of each tile and base item specified.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store tiles on flat surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

C. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

C. Furnish 10 linear feet for each 500 linear feet or fraction thereof, of each type and color of base installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Commercial Flooring www.armstrong.com

B. Azrock www.azrock.com

C. Mannington Commercial www.mannington.com

D. Tarkett, www.tarkett.com

E. Substitutions: Section 01 60 00 - Product Requirements.

2.2 PRODUCTS

A. **SVT-1,2,7** : Solid Vinyl Tile – ISO 10581.
   1. Basis of Design: *iQ Eminent* as manufactured by Tarkett or approved equivalent by specified manufacturer.
   2. Size: As scheduled.
   3. Thickness: 0.078 inch.
   4. Pattern/color: As scheduled.
   5. Bio-Based Tile Composition: Homogeneous vinyl. Color/pattern through the entire thickness.
      a. No surface wear layer.
   6. Low VOC emissions.
   7. Slip-Resistance: ADA compliant.
   8. Manufacturer’s Warranty: 15-years.

B. **SVT-3,4,5,6** : Solid Vinyl Tile - ISO 10581.
   1. Basis of Design: *iQ Optima* as manufactured by Tarkett or approved equivalent by specified manufacturer.
   2. Size: As scheduled.
   3. Thickness: 0.078 inch.
   4. Pattern/color: As scheduled.

5. Bio-Based Tile Composition: Homogeneous vinyl. Color/pattern through the entire thickness.
   a. No surface wear layer.
6. Low VOC emissions.
7. Slip-Resistance: ADA compliant.
8. Manufacturer's Warranty: 15-years.

2.3 RESILIENT BASE

A. Manufacturers:
1. Rubber Cove Base, Armstrong www.armstrong.com
2. Rubbermyte, Burke Flooring www.burkeflooring.com
3. Base 2000 Wall Base, Flexco www.flexcofloors.com
4. Rubber Cove Base, Johnsonite www.johnsonite.com
5. 700 Series Base, Roppe Corporation www.roppe.com
6. Series 700 Cove Base, VPI www.vpicorp.com
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Rubber Base: ASTM F1861, rubber, Type TP:
1. Height: 4 inch.
2. Thickness: 1/8 inch.
3. Finish: Smooth.
4. Length: Continuous rolls.
5. Style: Coved with top-set toe.

2.4 RESILIENT STAIR ACCESSORIES

A. Manufacturers:
1. Armstrong, www.armstrong.com
2. Burke Flooring, www.burkeflooring.com
3. Flexco, www.flexcofloors.com
4. Johnsonite, www.johnsonite.com
5. Roppe Corporation, www.roppe.com
6. VPI Flooring, www.vpicorp.com
7. Substitutions: Section 01 60 00 - Product Requirements.

2.5 ACCESSORIES

A. Subfloor Filler: Self-leveling or trowel-applied latex-modified cementitious type, ARDEX **SD-F** "**Feather Finish"** as manufactured by Ardex Engineered Cements.

B. Primers: Waterproof; types recommended by flooring manufacturer.

C. Adhesives:

1. Rubber Base: Latex type as recommended by base manufacturer for the particular substrate.

2. Flooring: Selected flooring manufacturer's premium adhesive with enhanced grip and slip resistance, capable of accepting full traffic load within 48 hours of installation.

   a. Basis of Design: Armstrong S-750 Premium Floor Tile Adhesive or approved equivalent by specified manufacturer.

D. Moldings and Edge Strips: Extruded aluminum, of height necessary to protect edges of tiles.
1. VCT, LVT, or VET to Carpet: Schluter-RENO-U, aluminum.

E. Sealer and Wax:
1. National Chemical Laboratories "24-7".
2. Apply minimum 3-coats of wax and buff to high sheen between coats and after final.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify that moisture content of the concrete slab does not exceed maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting. In no case shall moisture content exceed 85% RH per ASTM F 2170 testing.
   1. Perform deep-probe moisture meter testing per ASTM-F2170 for each area receiving the specified floor finish.
   2. Perform number of tests recommended by the flooring system manufacturer per each floor area, but no less than one test per each 1000 sq. ft.
   3. Provide written test results to the Architect, along with flooring manufacturer's recommended maximum moisture values.

C. Verify floor and lower wall surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials.

D. Starting installation of flooring indicates installer's acceptance of flooring substrate conditions.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed.

B. Lay flooring with joints and seams butted tight and parallel to building lines to produce symmetrical tile pattern.

C. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

D. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where flooring materials change.

F. Install flooring in recessed floor access covers. Maintain floor pattern.

G. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.4 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units or 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING AND WAXING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean and maintain all resilient flooring products.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Prohibit traffic on resilient flooring for 48 hours after installation.

C. Do not slide furnishings, equipment, or other objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels. Remove and replace damaged tiles.

END OF SECTION

SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Resilient exercise sheet flooring, adhesively applied with heat-welded seams. Installed over existing slab with new concrete infill.

B. Related Sections:
1. Section 09 65 00 – Resilient Flooring and Base: 4” rubber coved base.

1.2 REFERENCES

A. ASTM International:
1. ASTM-F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples:
1. Submit manufacturer's complete set of color samples for initial selection.
2. Submit two 12’ x 12” samples of each color/pattern specified.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing Work of this section with minimum three years’ experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Unroll sheet material and allow to relax in environmentally controlled room for 24 hours prior to installation.

C. Section 01 60 00 - Product Requirements.

D. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

E. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.7 WARRANTY

A. Provide manufacturer’s written material warranty against material defects and failures due to surface wear-through and moisture vapor intolerance.
1. Warranty Period: Minimum 15-years after Project Substantial Completion.

B. Provide installer's written warranty against defects in installation and workmanship.
   1. Warranty Period: Minimum 2-years after Project Substantial Completion.

1.8 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish additional 5% of packaged material for Owner's future use for each type, color, and pattern of flooring installed.

PART 2 - PRODUCTS

2.1 RUBBER FLOORING

A. Manufacturers:
   1. Tarkett Sports, www.tarkettsportsindoor.com
   2. Substitutions: Section 01 60 00 - Product Requirements.

B. Rubber Athletic Sheet Flooring: 100-percent recycled high-density rubber flooring.
   1. Basis of Design*: Tarkett Ominisports*.
   2. Color/texture as scheduled
   3. Construction: Embossed, homogeneous product of vulcanized natural and synthetic rubbers with mineral aggregates, stabilizing agents, and pigmentation.
      a. Surface: Printed faux wood design coated with clear PVC and UV cured urethane treatment.
      b. Foam force reduction layer: High density closed cell PVC foam with honeycomb embossing.
      c. Intermediate Layers: Reinforced with a non-woven fiberglass grid for dimensional stability.
      d. Total Thickness: Layers vulcanized to form 0.27" (7.1 mm) overall thick sheet.
      e. Antimicrobial treatment.
   4. Recyclability:
      a. Made from 30% recycled content and 100% manufacturing waste recycled.
      b. FloorScore certified.
   5. Wear Layer: Type 1 – Grade 1 per ASTM F1303/F410.
   6. Impact Resistance: Passes EN 1717.
   7. Ball Rebound: >90% per ASTM F2772.
   8. Fire Rating: Class I per ASTM E648.
   9. Roll Width: 6'-6".

2.2 ACCESSORIES

A. Primers and Adhesives: Waterproof; types approved by flooring manufacturer.

B. Seam Welding Rods: Matching color and compatible material provided by flooring manufacturer.

C. Game-Line and Marker Paint: Enamel or other approved product, compatible with flooring and recommended by flooring and paint manufacturers for use indicated.

   1. Colors: As indicated, or if not indicated, as selected by Architect from manufacturer's full range of line colors

D. Transition Strips: Beveled strips that transition smoothly from the surface of rubber athletic flooring to the adjacent flooring.

E. Rubber Base: Coved, 4-inch high as specified in Section 09 65 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Perform in-situ relative humidity testing (ASTM F2170) to determine moisture condition of concrete subfloor.

C. Verify concrete subfloors are dry to maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting. Maximum allowable amount of moisture emission from substrate is 3.0 pounds per 1,000 square feet in 24-hour period and shall not exceed 85% or the maximum allowable moisture content as recommended or allowed by flooring manufacturer.

1. Perform deep-probe moisture meter testing per ASTM-F2170 for each area receiving the specified floor finish.
2. Perform number of tests recommended by the flooring system manufacturer per each floor area, but no less than one test per each 1,000 sq. ft.
3. Provide written test results to the Architect, along with flooring manufacturer's recommended maximum moisture values.

D. Verify substrate surfaces are free of substances capable of impairing adhesion of new adhesive and finish materials.

E. Ambient temperature of installation area shall be maintained at 65-degrees F or greater.

F. Starting installation of flooring indicates installer's acceptance of flooring substrate conditions.

3.2 PREPARATION

A. Remove coatings, including curing compounds and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Clean and vacuum substrate thoroughly.

E. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

A. Lay flooring with joints and seams parallel to building lines. Provide wall-to-wall lengths where possible to avoid end seams. Gap seams uniformly for flush application of matching filler using heat-welded rods. Stagger end seams nominal 24".

B. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints

C. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

D. 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. Roll flooring for maximum adhesion and flatness using minimum 50 lb. roller.

2. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

E. Install manufacturer's pre-formed transition strips at exposed edges where flooring does not abut vertical surfaces.

F. Mask flooring at game lines and markers and apply paint to produce sharp edges and opaque coverage.

G. At movable partitions, install flooring under partitions without interrupting floor pattern.

H. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

I. Reference Section 09 65 00 for installation requirements of rubber base.

J. Remove excess adhesive from floor, base, and wall surfaces without damage.

K. Clean and maintain resilient flooring products.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.

C. Do not move heavy or sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

D. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 66 23 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Thin-set epoxy-resin terrazzo system.

B. Related Sections include the following:
   1. Section 01 23 00 – Alternates: Thin-set terrazzo as alternative floor finish at corridors as indicated.
   2. Division 3 Section - Cast-In-Place Concrete: For concrete substrate requirements.
   3. Section 07 90 00 – Joint Protection: For sealants installed in movement joints.
   4. Section 09 30 00 – Tile base.

1.2 REFERENCE STANDARDS

A. ASTM International:
   1. ASTM D-2240 – Standard Test Method for Rubber Property.
   2. ASTM D-638 – Standard Test Method for Tensile Properties of Plastics.
   3. ASTM D-695 – Standard Test Method for Compressive Properties of Rigid Plastics.
   4. ASTM D-709 – Standard Specification for Laminated Thermosetting Materials.
   5. ASTM D-1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

1.3 SUBMITTALS

A. Product Data: For each type of terrazzo, component material, and accessory specified.

B. Shop Drawings:Show terrazzo fabrication and installation requirements including plans, elevations, sections, component details, and attachments to other work.
   1. Show layout plan drawings of divider, control, and expansion joint strips. Include joint details with plans.
   2. Show layout of base and border strips.

C. Samples for Initial Selection: National Terrazzo and Mosaic Association (NTMA) color plates showing the full range of colors available for each terrazzo type indicated.

D. Samples for Verification: Minimum of three 6-inch square samples of each terrazzo color and type required, showing the full range of color, texture, and pattern variations expected.
   1. Terrazzo: 6-inch square samples.
   2. Accessories and Metal Strips: 6-inch long samples of each item required.

E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Material Certificates: Certificates signed by suppliers or manufacturers certifying that each material complies with requirements.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit procedures for stain removal, stripping, and sealing.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed terrazzo installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Marble: Obtain each color, grade, type, and variety of marble from one source with resources to provide materials of consistent quality in appearance and physical properties without delaying the Work.

C. NTMA Standards: Comply with the National Terrazzo and Mosaic Association's (NTMA) Guide Specification and written recommendations for terrazzo type indicated, unless more stringent requirements are specified.

D. Mockups: Prior to installing terrazzo, construct mockups for each type and color required to verify selections made under Sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mockups shall be built by the Subcontractor responsible for the Project Work. Build mockups to comply with the following requirements, using all conditions and materials indicated for the completed Work.
   1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect 7-days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before start of terrazzo work.
   5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. When directed, demolish and remove mockups from Project site.
   7. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work where there is no visible difference in color or finish from the final product.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Review methods and procedures related to installation including, but not limited to, the following
   1. Inspect and discuss required condition of substrate and other preparatory work performed by other trades.
   2. Review structural loading limitations.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review dust-control procedures.
   5. Convene prior to affected concrete floor slabs being poured, and again minimum one week prior to commencing work of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in suppliers' original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Maintain temperature above 50 deg F (10 deg C) for 48 hours before and during terrazzo installation.

B. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design: *EZPour Epoxy 158* by Terrazzco; terrazzco.com
   1. Hardness: ASTM D-2240, 83.5.
   2. Tensile Strength: ASTM D-638: 9,500 psi
   3. Compressive Strength: ASTM D-695: 13,000 psi
   4. Flexural Strength: ASTM D-790: 4,100 psi
   5. Chemical Resistance: ASTM D-1308

B. Marble Chips: Sizes conforming to NTMA gradation standards for approved mix, with Ha 10 minimum abrasive-hardness value when tested according to ASTM C 241, 0.75 percent maximum 24-hour absorption rate, dust content of less than 1-percent by weight, and containing no deleterious or foreign matter.

C. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.

D. Metal Strips
   1. Divider Strips: 1/8-inch thick white alloy of zinc top strip, galvanized steel bottom strip, with anchoring features.
   2. Control Joint Strips: Separate, double-L type angle or straight strips positioned back-to-back, matching material, thickness, and color of divider strips.
   3. Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
   4. Adhesive: Epoxy-resin adhesive recommended by manufacturer for this use and acceptable to thin-set terrazzo resin manufacturer.

E. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate crack preparation and reflective crack reduction.
   1. Reinforcement: Fiberglass scrim.
   2. Location: Over all Cracks and Joints in substrate.

F. Primer: Two-component resin or other compound recommended by thin-set terrazzo resin manufacturer for priming substrate.

G. Finishing Grout: Thin-set terrazzo resin manufacturer's resin-based finishing grout for filling voids.

H. Sealer: Slip-resistant and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 12, does not affect color or physical properties of the installed terrazzo, is recommended by sealer manufacturer for this use, and complies with NTMA Guide Specification for the installed system.

2.2 MIXES

A. Thin-Set Epoxy-Resin Terrazzo: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and decorative chip proportions and mixing.
   1. Formulated Mix Color and Pattern: Match approved sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of terrazzo. Do not proceed with installation until unsatisfactory conditions, including levelness tolerances, have been achieved.

3.2 PREPARATION

A. Clean substrates of substances that impair terrazzo's bond, including oil, grease, and curing compounds.
   1. Roughen concrete substrates by use of powered shot-blasting equipment before installing terrazzo or underbed. Substrate finish shall be in accordance with NTMA's written recommendations.
   2. Prepare thin-set-terrazzo substrates according to resin manufacturer's written instructions.

B. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with governing environmental protection regulations.
   1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

C. Verify that concrete substrates are visibly dry and free of moisture.

D. Moisture Testing:
   1. Test substrate for moisture content by method recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.

3.3 INSTALLATION

A. General: Comply with NTMA Guide Specification for terrazzo type indicated and NTMA's written recommendations for substrate preparation and terrazzo installation.

B. Prime thin-set-terrazzo substrates according to resin manufacturer's written instructions.

C. Install divider and accessory strips according to NTMA's written recommendations.

D. Install control-joint strips back-to-back directly above substrate control joints and according to NTMA's written recommendations. Provide gap between strips for sealant installation.

E. Install angle or T-strips and similar accessories in adhesive setting bed without voids below strips. Provide mechanical anchorage of strips as required for adequate attachment of strips to substrate.

F. Thin-Set Terrazzo: Place, cure, grind, grout, and finish thin-set terrazzo according to resin manufacturer's written instructions and NTMA Guide Specification for terrazzo type indicated. Ensure fluids from grinding operations do not react with divider and control-joint strips, or stain decorative chips. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

G. Cut out and replace terrazzo areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

H. Construction Tolerances: Limit terrazzo surfaces' variation from level to 1/4 inch in 10 feet.

3.4 CLEANING AND PROTECTING

A. Remove grinding dust from installation and adjacent areas.

B. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's

written instructions.

C. Rinse surfaces with water and allow to dry thoroughly.

D. Seal surfaces according to NTMA's written recommendations. Apply sealer according to sealer manufacturer's written instructions.

E. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure terrazzo is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 09 68 16 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sheet carpet, fully adhered.

B. Section includes modular walk-off carpet, fully adhered.

C. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete: Subfloor.
2. Section 09 65 00 - Resilient Base: Rubber base for areas receiving carpeting.

1.2 REFERENCES

A. Carpet and Rug Institute: CRI 104 - Standard for Installation of Commercial Carpet.

B. Consumer Products Safety Commission: CPSC 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs.

C. National Fire Protection Association: NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source.

D. ASTM F2170-11 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of joints, direction of carpet pile, patterns and colors, and location of edge moldings.

C. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

D. Samples:
1. Submit two samples of carpet, 12 x 12 inches in size, illustrating color and pattern design for each type and color of carpet selected.
2. Submit two 12-inch long samples of edge strip and accessories.

E. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit maintenance procedures, including:

1. Methods for maintaining carpet, 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.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics.
1. Class I, minimum 0.45 watts/sq cm when tested in accordance with NFPA 253.
2. CPSC 16 CFR 1630.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing work of this section and is approved by manufacturer.
   1. FCIB or IFCI certified carpet installers or demonstrate compliance with certification program requirements.

1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Store materials in area of installation for 48 hours prior to installation.

C. Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

D. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 20 year warranty for materials and labor.

1.11 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Supply extra carpet minimum 5% of the amount installed for each type and color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Tarkett; commercial.tarkett.com
B. Substitutions: None.

2.2 SELECTIONS

A. **Sheet Carpet**: Basis of Design; *Angulate*, product of Tarkett, color and pattern as indicated in the Finish Schedule.
   1. Roll Width: 6 feet.

2. Primary Backing: Powerbond with Tandus Seam Weld #54.
3. Construction: Stratatec® Patterned Loop in Dynex SD® Nylon.
4. Recycled Content: 56%.
5. Face Weight: 21 oz./sq. yd.
6. Gauge: 5/64.
7. Stiches per Inch: 10.7.
8. Pile Height Average: 0.187 inch.
9. Dye Method: 75% Solution Dyed.
10. Soil/Stain Protection: Eco Ensure.

B. **Walk-Off Carpet:** Basis of Design: *Assertive Action* as manufactured by Tarkett.
1. Roll Width: 6 feet.
2. Primary Backing: Non-woven synthetic fiber.
3. Construction Type: Patterned Loop in Dynex SD® Nylon.
4. Face Weight: 17 oz./sq. yd.
5. Gauge: 5/64.
6. Stiches per Inch: 8.5.
7. Pile Height Average: 0.187 inch.
8. Dye Method: 90% Solution Dyed.
9. Soil/Stain Protection: Eco Ensure.
10. Color: As scheduled.

2.3 ACCESSORIES

A. Sub-Floor Filler: Self-leveling latex-modified cementitious type, ARDEX SD-F “Feather Finish” as manufactured by Ardex Engineered Cements.

B. Moldings and Edge Strips: Approved metal edge strips mechanically-fastened at exposed edges abutting resilient tile surfaces; height as required to protect carpet edge.

C. Seam Adhesive: Type recommended by manufacturer.

D. Adhesive: Manufacturer’s peel-and-stick self-adhesive system.

2.4 EXTRA MATERIAL

A. After completion of installation, carpet subcontractor shall provide an additional three (3) percent of total yards installed of each carpet specified to the Owner for future use.

B. Required extra material stock shall be packaged in unused rolls. Any large remnants provided to Owner shall be in addition to required material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify floor surfaces are smooth and flat within tolerances specified in Section 03 30 00 and are ready to receive work.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and:
1. Revise subparagraph below to suit Project.
2. 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 the carpet manufacturer.
3. Subfloor finishes comply with requirements specified in Section 03 30 00 for slabs receiving carpet.
4. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

D. Verify concrete floors are dry to maximum moisture content as recommended by manufacturer, and exhibit negative alkalinity, carbonization, and dusting.

1. Maximum allowable amount of moisture emission from substrate is 3.0 pounds per 1,000 square feet in 24-hour period, and also shall not exceed maximum allowable moisture content as recommended or allowed by flooring manufacturer.

2. Perform deep-probe moisture meter testing per ASTM-F2170 for each area receiving the specified floor finish. Provide written test results to the Architect, along with flooring manufacturer's recommended maximum moisture values.

E. Starting installation of flooring indicates installer's acceptance of flooring substrate conditions.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. 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 the carpet manufacturer.

C. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

E. Clean substrate.

3.3 INSTALLATION

A. Sheet Carpet
1. Install carpet in accordance with CRI 104, Pre-Applied Adhesive Systems (Peel and Stick).
2. Verify carpet match before cutting to ensure minimal variation between dye lots.
3. Lay out carpet and locate seams in accordance with CRI 104 section 7.2:
   a. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   b. Do not locate seams perpendicular through door openings.
   c. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   d. Locate change of color or pattern between rooms under door centerline.
   e. Provide monolithic color, pattern, and texture match within each contiguous area.
4. Install carpet tight and flat on subfloor, well fastened at edges, with uniform appearance.
5. Double cut carpet seams.
   a. Make cuts straight, true, and unfrayed.
   b. Apply a bead of carpet manufacturer's seam sealer to the cut edge at proper height to seal all edges. Thoroughly clean all seams
6. Self-Adhesive Installation:
   a. Apply primer to floor uniformly at rate recommended by manufacturer.
   b. Apply seam sealer. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
   c. Roll with 100 lb. roller for complete contact of carpet backing to floor.
7. Trim carpet neatly at walls and around interruptions.
8. Complete installation of edge strips, concealing exposed edges.

B. Carpet Tile
1. Install carpet tile in accordance with CRI 104, Section 10.4, Pre-Applied Adhesive Systems (Peel and Stick).
2. Do not mix carpet from different cartons unless from same dye lot.
3. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
4. Install carpet tile in square pattern, with pile direction alternating to next unit, set parallel to building lines.
5. Install carpet tight and flat on subfloor, well fastened at edges, with uniform appearance.
6. Double cut carpet seams.
   a. Make cuts straight, true, and unfrayed.
7. Self-Adhesive Installation:
   a. Apply primer to floor uniformly at rate recommended by manufacturer.
   b. Apply seam sealer. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
   c. Roll with 100 lb. roller for complete contact of carpet backing to floor.
8. Trim carpet neatly at walls and around interruptions.
9. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Vinyl wall covering.

B. Related Sections:
   1. Section 09 21 16 - Gypsum Board Assemblies: Wall substrate.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
   2. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls.

C. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on covering and adhesive.

A. Shop Drawings: Indicate wall elevations with seaming layout.

C. Samples: Submit two samples of each covering, 12x12 inch in size illustrating color, finish, and texture.

D. Manufacturer's Installation Instructions: Submit special installation procedures and perimeter conditions requiring special attention.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics:
   1. Textile Wall Coverings: Comply with one of the following:
      a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
      b. Comply with requirements of applicable code when tested in accordance with NFPA 265 Method A or Method B test protocols.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with

minimum three years' experience.

B. Installer: Company specializing in performing work of this section and approved by manufacturer.

1.7 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Inspect roll materials on site to verify acceptance.

C. Protect packaged adhesive from temperature cycling and cold temperatures.

D. Do not store roll goods on end.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by adhesive or vinyl covering product manufacturer.

C. Maintain these conditions 24 hours before, during, and after installation of adhesive and covering.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. BoltaWall
B. Essex
C. GenCorp Polymer
D. Genon.
E. Koroseal
F. MDC Wallcoverings
G. Carnegie Fabrics
H. Maharam

2.2 WALL COVERING

B. Wall Covering: FS CCC-W-408A and CFFA-W-101-A, Type II, Medium Duty; vinyl coated fabric roll stock, conforming to the following:
1. Total Weight: 20 – 21 oz/sq yd.
2. Roll Width: 54 inches.
3. Backing:
4. Basis of Design: As scheduled, or approved equivalent in color and pattern by specified manufacturer.

A. Adhesive: Use only mildew-resistant type as recommended by wall covering manufacturer.

C. Release Coat: Provide sealer or undercoat for new gypsum wallboard substrates as recommended by wallcovering manufacturer.

D. Substrate Filler: As recommended by adhesive and covering manufacturers; compatible with substrate.

B. Substrate Primer and Sealer: Type recommended by covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces are ready to receive work, and conform to requirements of covering manufacturer.

C. Measure moisture content of surfaces using electronic moisture meter. Do not apply coverings unless moisture content of surfaces are below the following maximums:
1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Wood Surfaces: 15 percent, measured in accordance with ASTM D4442.

D. Verify flatness tolerance of surfaces does not vary more than 1/8 1/4 inch in 10 feet nor vary at rate greater than 1/16 inch/ft.

3.2 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Apply primer sealer to substrate surfaces as required, in accordance with manufacturer’s instructions. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.3 INSTALLATION

A. Use covering in roll number sequence. Change run numbers at partition breaks and corners only.

B. Razor trim edges on flat work table, changing blade often to prevent rough cut edges. Do not razor cut on gypsum board surfaces.

C. Apply covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.

D. Horizontal seams are not acceptable.

E. Adhesive shall be mildew resistant.

F. Do not seam within 2-inches of internal corners or within 6-inches of external corners.

G. Remove excess adhesive while wet from seam before proceeding to next covering sheet. Wipe clean with dry cloth.

H. Trim within ¾” of top of resilient base.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean coverings of excess adhesive, dust, dirt, and other contaminants.

C. Reinstall wall plates and accessories removed prior to work of this section.

END OF SECTION

SECTION 09 72 16.16 – RIGID SHEET VINYL WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Adhesive-applied rigid plastic wall covering.

B. Related Sections:
   1. Section 09 21 16 – Gypsum Board Assemblies: Substrate finish.
   2. Section 09 90 00 – Painting and Coating.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Drawings: Provide scaled drawings of wall elevations indicating proposed joint and trim locations.

C. Product Data: For each product indicated.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
   2. Manufacturer’s product data sheet(s) for plastic sheets, adhesive, and any related accessories.
   3. Manufacturer’s installation procedures.

D. Samples for Verification:
   1. Plastic sheet physical samples: Nominal 6 by 6 inches each, for each selected type, color, pattern, and surface finish.

E. Qualification Data: For installation firm to demonstrate capabilities and experience. Include lists of completed projects with project names, locations, and dates, names and contact information of the projects’ architects and owners.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed wall protection installation similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

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

C. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 WARRANTY

A. Manufacturer’s warranty: Minimum two-year warranty against defects in materials.

B. Installer’s warranty: Minimum two-year warranty against defects in installation and workmanship.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Preinstallation Meetings.

B. Conduct conference at Project site to comply with requirements in Section 01 31 19 - Project Meetings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Do not deliver wall protection sheets until painting and similar operations that could damage materials have been completed in installation areas. If materials 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 materials until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering rigid sheet plastic wall protection that may be incorporated into the Work include, but are not limited to, the following:
   1. Construction Specialties, Inc., www.c-sgroup.com.
   2. Koroseal Wall Protection Systems, www.koroseal.com
   3. Substitutions: Section 01 60 00 - Product Requirements**.**

2.2 SYSTEM

A. Basis of Design: *Acrovyn High-Impact Wall Covering* as manufactured by Construction Specialties, or approved equivalent by specified manufacturer.
   1. Sheet Material:
      a. Type: Rigid high-impact rigid non-PVC plastic sheet with Thickness: Nominal 0.040” unless noted otherwise in the drawings.
      b. Fire Performance Characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class A/1 characteristics listed below:
         1) Flame Spread: 25 or less.
         2) Smoke Developed: 450 or less.
      c. Impact Strength: Provide wall protection components that have been tested in accordance with the applicable provisions ASTM F476.
      d. Finish: Suede.
      e. Color(s): As indicated.
   2. Trimless: Use no trim at vertical joints and inside corners. Leave 1/8” gap for manufacturer’s “Color Match” sealant.

B. Mounting Adhesive:
   1. System manufacturer’s water-based or contact adhesive.

C. Wall Primer:

1. System manufacturer’s recommended water-based wall primer for unpainted walls.

PART 3 - EXECUTION

3.1 EXAMINATION AND COORDINATION

A. Examine substrates scheduled to receive wall protection sheets for compliance with system manufacturer's requirements and conditions affecting performance.
   1. Wall surfaces to receive materials shall be dry and free from dirt, grease, loose paint, and scale.
   2. Wall surfaces shall be flat.
   3. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Coordinate with Project painting contractor to determine preferred painting condition of wall prior to beginning installation of wall protection sheets. Where installation is to begin prior to painting, determine whether priming is recommended by wall protection manufacturer.

3.2 ENVIRONMENTAL CONDITIONS

A. Do not install wall protection sheets until wet construction work is complete and ambient air at installation space has stable relative humidity of less than 80%, and room temperature is stabilized between 65 and 75 degrees F.

B. Do not install wall protection sheets until materials have been acclimated to ambient temperature and humidity conditions for minimum of 48 hours. Stack and space sheets out of direct sunlight for acclimation procedures to facilitate adequate ventilation.

C. Provide heat, light, and ventilation prior to installation.

D. Maintain room temperature and humidity for period of three days prior to delivery of materials to installation space, during installation, and continuously after installation.

3.3 INSTALLATION

A. General: Install system in strict accordance with manufacturer’s printed requirements and recommendations using manufacturer’s standard primers, adhesives, and trims.

B. Primer: Where recommended by system manufacturer, prime portion of walls to receive wall protection sheets using system manufacturer’s recommended primer.
   1. Where walls are painted prior to installation, determine compatibility of mounting adhesive with painted wall.
   2. Protect wall adjacent surfaces during wall protection sheet installation.

C. Install wall protecton sheets level, plumb, true, and straight with full adhesion to substrate and without distortions.

D. Install wall protection sheets using specified trim at top and bottom of any horizontal color-change bands, and at inside and outside corners.

E. Install manufacturer’s color-matching sealant neat and flush with vinyl face at all vertical joint gaps.

3.4 ADJUSTING AND CLEANING

A. Clean installed wall protection sheets. Replace any damaged sheets or trim and adjust for uniform appearance.

B. Remove any wall paint from trim or wall protection sheets.

END OF SECTION

SECTION 09 77 00 - FRP WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: FRP pre-laminated wall panels.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Include physical characteristics, installation methods for each different type of substrate, and maximum permissible moisture content of substrates.

C. Shop Drawings: Show location and extent of wall panels, panel terminations, installation details, and elevations showing nonstandard conditions.

D. Samples for Initial Selection: For initial selection of color, pattern and surface texture, provide the manufacturer's standard color chips consisting of actual sections of each FRP wall panel and vinyl plastic material required showing the full range of materials, colors, and textures available.

E. Samples for Verification: Provide the following samples for verification of compliance with requirements indicated. Prepare samples from the same material to be used in the Work.
1. 6-inch by 6 inch square samples of each wall panel material required for verification of color, pattern, and texture selected.
2. 1- inch long sample of each molding accessory.

F. Product Test Reports: From a qualified independent testing laboratory showing compliance of FRP wall panel materials with requirements indicated based on tests performed by the laboratory within the past five years.

G. Maintenance data for FRP wall panel material components for inclusion in the operating and maintenance manuals specified in Division 1.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has previously installed FRP wall panel materials similar in design and extent to the materials required on this Project.

B. Fire Performance Characteristics: Provide FRP wall panels that are identical to those tested in accordance with ASTM E 84 for the fire performance characteristics indicated below. Identify wall panel materials with appropriate markings from the testing and inspection organization.
1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

C. Single Source Responsibility: Obtain each color, texture, grade, finish, and type of FRP wall panel material from a single source with resources to provided products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original factory wrappings, clearly labeled with identification of manufacturer, brand name, lot number, quality or grade, and fire hazard classification.

B. Store materials inside in original undamaged packages in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Do not store rolled goods upright; lay flat, blocked off the ground to prevent sagging and warping.

1. Maintain room temperature within the storage area at not less than 70 deg F during the period FRP wall panel and accessory materials are stored. Keep material out of direct sunlight to avoid surface distortion.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Do not install FRP wall panel material until the space to receive the wall panel material is enclosed and weatherproof. Do not install materials until the ambient temperature within the building is maintained and stabilized at not less than 70 deg F for not less than 72 hours prior to beginning of the installation.

1.6 SEQUENCING AND SCHEDULING

A. Schedule installation with other construction activities to minimize the possibility of damage and soiling during the remainder of the construction period.

1.7 MAINTENANCE

A. Maintenance Instructions: Provide the manufacturer's instructions for maintenance of installed work. Include recommended methods and frequency for maintaining materials in optimum condition under anticipated traffic and use conditions. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products:
1. Fire-X Glasbord, Kemlite Company, www.kemlite.com.
2. Substitutions: 01 16 00 - Product Requirements.

2.2 FRP WALL PANELS

A. Wall Panels: Provide manufacturer's standard FRP wall panels. Panels shall consist of 0.09-inch thick, textured, USDA approved panel.

B. Sheet Size: 4 by 10 feet, cut for 5 ft. high wainscot.

C. Colors and Textures of Plastic Material: Provide plastic material that matches color and texture indicated by reference to the manufacturer's standard color and texture designation.

D. Adhesive: Provide the type of adhesive recommended by the manufacturer for use with the wall panel material on the substrate indicated.

E. Trim: Provide extruded, impact-resistant, vinyl plastic trim members matching color of wall panel materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates scheduled to receive FRP wall panel materials for compliance with manufacturer's requirements and conditions affecting performance.
1. Wall surfaces to receive FRP wall panel materials shall be dry and free from dirt, grease, loose paint, and scale.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prior to installation, clean substrate to remove dust, debris, and loose particles. Provide skim coat over rough walls to smooth surface.
   1. Complete all finishing operations, including painting, before beginning installation of FRP wall panel materials.
   2. Test masonry and plaster substrates to receive FRP wall panel with an electronic moisture meter. Moisture content shall be within manufacturer's recommended limits.
   3. Prime and seal substrates, if required, in accordance with the FRP wall panel material manufacturer's recommendations for the type of substrate.

3.3 INSTALLATION

A. General: Install FRP wall panel materials in accordance with manufacturer's recommendations using adhesive recommended for use over the substrate.
   1. Moldings: Furnish moldings for perimeter edging where indicated. Install moldings in the longest practical lengths. Tightly butt end joints and miter corners.
   2. Installation Type: full wall height, from top of wall base to 8 inches above ceiling.

3.4 CLEANING

A. General: Immediately upon completion of installation, clean FRP wall panels and accessories using a manufacturer's recommended cleaning agent. Clean moldings in accordance with the manufacturer's recommendations.

B. Remove excess adhesive, using methods and materials recommended by manufacturer.

C. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work, and leave areas of installation in neat, clean condition.

END OF SECTION

SECTION 09 77 23 – FABRIC WRAPPED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fabric-wrapped acoustical wall panels, absorptive type for acoustical panels mounted above 9 ft. from finish floor level.
2. Fabric-wrapped impact resistant wall panels for acoustical panels mounted below 9 ft. from finish floor level.
3. Fabric-wrapped tackable wall panels for corridors, classrooms, job-built display cases, and other locations as may be indicated.

1.2 SUBMITTALS

A. Shop Drawings: Submit shop drawings showing layout and components, including details of hanging method for wall panels and suspension method for baffles, accessories. Identify each panel and baffle as to size, type, and fabric.

B. Product Data: Submit manufacturer's technical data for each type of acoustical panel and baffle required.

C. Submit manufacturer's standard size swatches of scheduled fabric for each type of panel and facing material required.

D. Certified Test Reports: Submit test data from an independent testing agency, acceptable to authorities having jurisdiction, evidencing that panel assemblies comply with requirements indicated for fire performance characteristics.

E. Certificates: Submit certificates from manufacturers of acoustical panels attesting that their products comply with specified requirements including those for fire performance characteristics.

1.3 QUALITY ASSURANCE:

A. Fire Performance Characteristics: Provide acoustical panels, with surface-burning characteristics as indicated below, which have been determined by testing assemblies of identical materials and construction according to ASTM E 84 by a testing organization acceptable to authorities having jurisdiction.
1. Flame Spread: 25 or less.
2. Smoke Developed: 450 or less.

1.4 PRODUCT HANDLING:

A. Protect acoustical wall panels from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until "wet work" such as concrete and plaster have been completed and cured to a condition of equilibrium.

1.5 PROJECT CONDITIONS:

A. Do not begin installation until spaces to receive acoustical panels have been enclosed and maintained at approximately the same humidity and temperature conditions as planned for occupancy. Maintain temperature and humidity as recommended by panel manufacturer.

1.6 EXTRA MATERIALS:

A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with appropriate labels:
   1. Fabrics: Furnish quantity of each fabric equal to 5.0 percent of each type of fabric installed.
   2. Fabric shall be provided in continuous rolls, packaged for storage.

PART 2 - PRODUCTS

2.1 GENERAL

A. MANUFACTURERS: Subject to compliance with requirements, approved manufacturers include the following:
   1. Acoustical Surfaces, Inc. www.soundsilencer.com
   2. Conwed, Inc.
   3. Decoustics. www.decoustics.com
   4. Golterman & Sabo, www.golterman.com
   5. Lamvin http://www.lamvin.com
   6. MBI Products Company, www.mbiproducts.com
   7. Wall Technology. www.walltechnology.com

2.2 FABRICATION - GENERAL:

A. Fabricate panels to sizes and configurations indicated; attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from wrinkles, sags, blisters, seams, adhesive or other foreign matter.
   1. Fabricate back-mounted panels in factory to sizes required to fit wall surfaces based on field measurements of completed substrates indicated to receive wall panels.
   2. Fabricate suspended baffles in factory to indicated sizes, complete with hanging system.
   3. Each panel shall be faced with approved fabric bonded directly to the panel face and edges. Provide panels with flat, wrinkle-free surface, and tailored corners.

B. Provide panel manufacturer's accessories for securely mounting panels of type and size indicated to substrates provided and complying with the following requirements:
   1. Provide manufacturer’s 2-part zee-clips with one-part screw-fastened to back of panel and receiving part fastened to wall using appropriate anchoring. In addition, provide heavy-duty Velcro anchoring to stabilize panel and provide resistance to removal.
   2. Unless indicated otherwise, anchoring system shall be designed to hold back of panel within 1/4” of wall surface.

2.3 ACOUSTICAL WALL PANELS:

A. Sound Absorption Performance: Provide acoustical panels with noise reduction coefficients (NRC) indicated as determined by testing per ASTM C 423 for mounting type specified under individual product requirements.

B. Octave Band Center Frequencies (Hz)/Nominal Absorption Coefficient: Panels tested at 2” thick shall have the following nominal octave band absorption coefficients within a tolerance of plus or minus 5% when mounted directly on a hard surface:
   125/0.40
   250/0.98
   500/1.00
   1000/1.00
   2000/1.00

4000/1.00

C. Back-Mounted Edge-Reinforced Acoustical Wall Panels: Manufacturers standard panel construction consisting of scheduled fabric laminated to front, edges and back border of molded glass fiber board core, with edges chemically hardened to a minimum depth of 1/8" to reinforce panel perimeter against warping and edge damage. structural framing using wood, plastic, or metal will not be accepted:

D. Basis of Design:
1. Typical Panels: Decoustics *Type AP2* for panels located above 9’-0” or approved equivalent by specified manufacturer or approved equivalent by specified manufacturer.
   a. Core Density: 7 lbs. per cu. ft.
   b. Panel Face Size: As indicated.
   c. Panel Thickness: 2” or as indicated in the drawings.
   d. Edge Detail: Square, fabric wrapped.
   e. Fabric: Carnegie wall coverings www.carnegiefabrics.com;
      1) *Xorel #6427 Meteor* Acoustical Panel Textile with manufacturer’s *X Protect* wall backing.
      2) Width: 56”.
      3) Weight: varies from 12 oz per linear yd.
      4) Flame Retardancy: ASTM E84 Class A / Class 1.
      5) Cleanability: Water, solvent and bleach cleanable.
      6) Fabric Manufacturer’s Warranty: 10-years.
      7) Color(s) and pattern(s) as scheduled.
2. Impact-Resistant Wall Panels: Decoustics *Type HIR* for wall panels located at any height in a gymnasium, below 9’-0” in other parts of the building or identified on the drawings as “Impact-Resistant”.

   a. Use for panels mounted with any portion of panel installed at a height of less than 9'-0" above finish floor.

   b. Provide construction as specified above plus impact-resistant rigid fiberglass sheet laminated to front, edges, and back border of glass fiber board core.

2.4 TACKABLE WALL PANELS

A. Back-Mounted Edge-Reinforced Tack Panels: Manufacturers standard panel construction consisting of scheduled fabric laminated to front, edges and back border of molded glass fiber board core, with tackable facer, and chemically hardened edges to provide panel perimeter reinforced against warping and edge damage. Structural framing using wood, plastic, or metal will not be accepted.
1. Basis of Design: *Type H.I.R. #1, Tackable* panels as manufactured by Decoustics or approved equivalent by specified manufacturer.
2. Core Density: Minimum 7 lbs. per cu. ft.
3. Panel Face: Smooth high-density fiberglass facer for tackability.
4. Edges: Resin hardened.
5. Panel Thickness: 1” or as indicated in the drawings.
6. Edge Detail: Square unless otherwise indicated.
7. Fabric: Specified Carnegie *Xorel #6427 Meteor in scheduled color/pattern.*

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level, and in alignment with other panels,

1. Scribe to fit adjoining work accurately at borders and at penetrations.

2. Comply with panel manufacturer's printed instructions for installation of panels using type of mounting accessories as specified above.

3. Remove and replace panels which are damaged and are unacceptable to Architect.

END OF SECTION

SECTION 09 90 00 - PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of paints, stains, varnishes, and other coatings.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
   2. It is the intent of this Section that all exterior and interior materials normally requiring finish paint, coating, or stain/finishing as determined by the Architect, will be painted, coated, or stain/finished under this Section except for specialty coatings and finishes specifically covered under other Sections.
   3. Where the Bidder is uncertain of whether a specific item is intended to be painted, coated, or stain/finished, contact the Architect during the Bidding period for clarification.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: Shop primed items.
   2. Section 05 12 00 – Structural Steel: Shop primed items of structural steel to remain exposed.
   3. Section 05 21 00 – Steel Joists and Joist Girders: Shop primed items of steel joists and joist girders to remain exposed.
   4. Section 09 21 16 - Gypsum Board Assemblies: Surface preparation of gypsum board.
   5. Section 09 96 53 – Elastomeric Coatings: Coating at exposed inside face of CMU at mechanical courtyard walls, and where specifically indicated.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
   2. Exposed High Roof Decks:
      a. Library and Corridor: Protect prefinished metal roof deck. Painting required only at exposed steel structure or gypsum board covered structure
      b. Gymnasium: Clean and paint galvanized roof deck and exposed structure.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Plastic laminate faced casework and millwork.
      b. Acoustical wall panels.
      c. Toilet compartment doors and partitions.
      d. Metal lockers.
      e. Finished mechanical and electrical equipment, unless roof-top equipment visible from ground level.
      f. Light fixtures.
      g. Hardware.

   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
      d. Utility tunnels.

e. Pipe spaces.
f. Duct shafts.
g. Elevator shafts.

3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
   e. Electrical or control panels

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 REFERENCES

A. ASTM International:
   1. ASTM D16 - Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
   2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   3. ASTM D3359 – Standard Test Method for Measuring Adhesion by Tape Test.

B. Painting and Decorating Contractors of America:
   1. PDCA - Architectural Painting Specification Manual.

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss and satin refer to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit the following for each product specified; include primers and block fillers.
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference 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 coating material.

C. Samples: 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. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
3. Submit two Samples on the following substrates for Architect's review of color and texture only:
   a. Concrete: 4 inch square Samples for each color and finish.
   b. Concrete Unit Masonry: 4 x 8 inch Samples of masonry, with mortar joint in the center, for each finish and color.
   c. Painted Wood: 12 inch square Samples for each color and material on hardboard.
   d. Stained or Natural Wood: 4 x 8 inch Samples of natural or stained wood finish on representative surfaces.

D. Paint Schedule: Submit schedule of proposed paint type and sheen for each room. Use room names and numbers as appearing in the Architect’s drawings.

1.5 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALITY ASSURANCE

A. Obtain primers and block fillers from the same manufacturer as the finish coats.

1.7 QUALIFICATIONS

A. Applicator: Company specializing in performing work of this section on projects similar in materials, design, and extent to those of this project, and whose work has resulted in applications with successful in-service performance.

1.8 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Provide a full-coat mock-up for 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 or surface to represent surfaces and conditions for application of each type of coating and substrate.
      a. Wall Surfaces: Provide mock-up on at least 100 sq. ft.
      b. Small Areas and Items: Architect will designate items or areas required.
   2. Apply mock-up samples according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from mock-ups.

1.9 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.
1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.12 SEQUENCING

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

B. Sequence application to the following:
1. Do not apply finish coats until paintable sealant is applied at all joints and transitions of differing material.
2. Back prime wood trim before installation of trim.

1.13 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for paints and coatings.

1.14 EXTRA MATERIALS (attic stock)

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Supply additional unopened cans of each color, type, and sheen of paint to the Owner for future use as follows:
1. 10-gallons of each type and color used for walls, ceilings, steel doors, and exposed structure.
2. 3-gallons of each type and color used for door frames, trim, and accents.

C. Label each container with color, type, texture, and locations used in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 PAINTS AND COATINGS

A. Manufacturers:

1. Benjamin Moore & Co. www.benjaminmoore.com
2. Kelly-Moore Paint Co. www.kellymoore.com
3. Pittsburgh Paints www.pittsburghpaints.com
4. Sherwin-Williams Co. (Sherwin-Williams). www.sherwin-williams.com
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Applications Schedules:
1. Reference Schedules under Part 3 below for locations and applications of specific paint systems, coatings, stains, finishes, and sealers for this Project.
2. Certain of the paint and coating systems specified in Part 2 may not be required or scheduled for this particular Project.

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
2. For good flow and brushing properties.
3. Capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

E. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

F. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

G. Alternate Manufacturers: Sherwin-Williams products are specified. Equivalent products by listed manufacturers are acceptable upon approval by Architect.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

H. Colors: As indicated in the Color Schedule in the Drawings.

I. 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/L.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated latex block fillers.
1. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils per coat.

2.4 EXTERIOR PRIMERS

A. Exterior Metal Field Primers:
1. Factory-formulated metal primer for galvanized or bare metal without shop primer.
a. Sherwin-Williams; Pro-Cryl Universal Water Based Primer, B66 Series: Applied at a dry film thickness of 2.0 – 4.0 mils per coat.
2. Field Welds in Galvanized Metal:
a. ZRC Worldwide “Galvilite” zinc-rich coating.

B. Shop Primers: Typically applied by steel or miscellaneous metals fabricator.
a. Verify compatibility of finish paint with shop-applied primers.
b. Reference Division 5 metals sections for special epoxy shop primers required at items specified or indicated to be shop primed and field painted with urethane alkyd enamel.

C. Exterior Concrete and Masonry Primer: Factory-formulated masonry primer for exterior application:
1. Sherwin-Williams; Loxon Masonry Primer A24W300: Applied at a dry film thickness of not less than 3.0 mils.

2.5 EXTERIOR FINISH COATS.

A. Urethane Alkyd Enamel: Factory-formulated full-gloss urethane alkyd enamel for exterior application.
1. Sherwin-Williams; Industrial Urethane Alkyd Enamel, B54E51: Applied at a dry film thickness of 2.0 – 4.0 mils per coat.

B. Exterior Alkyd Enamel: Factory-formulated formulated full-gloss alkyd enamel for exterior application.
1. Sherwin-Williams; Industrial Enamel B-54WZ101: Applied at a dry film thickness of not less than 2.0 mils per coat.
2. Apply two (2) coats over specified primer.

C. Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.
1. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series: Applied at a dry film thickness of not less than 1.5 mils.
2. Apply two (2) coats over specified primer.

D. Concrete Curb Enamel:
1. Sherwin-Williams; H&C Concrete Sealer Solid Color solvent-based flat enamel (fire lane curbs).
2. Finish Coats: Two coats specified exterior full-gloss alkyd enamel.

2.6 INTERIOR PRIMERS

A. Interior Concrete and Concrete Masonry (CMU) Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
1. Sherwin-Williams; Loxon Concrete & Masonry Primer, A24W8300: Applied at a dry film thickness of not less than 3.0 mils per coat.
2. Use equivalent zero VOC primer when building will be occupied by students or staff within 5 days after application

B. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Sherwin-Williams; Pro Mar 200 Zero VOC Latex Primer B28W2600 Series: Applied at a dry film thickness of not less than 1.5 mils per coat.

C. High Performance Gypsum Board Primer: Factory-formulated acrylic primer for application under epoxy finish coats.
   1. Sherwin-Williams; PrepRite 200 Latex Wall Primer B28W200 Series: Applied at a dry film thickness of not less than 1.0 mils per coat.

D. Interior Ferrous Metal Primer: Factory-formulated for galvanized or bare metal not shop primed.
   1. Sherwin-Williams; Pro Cryl Universal Water Based Primer B66 series: Applied at a dry film thickness of 2.0 – 4.0 mils per coat.
   2. Reference Division 5 metals sections for special epoxy shop primers required at items specified or indicated to be shop primed and field painted with urethane alkyd enamel

E. Interior Dryfall Undercoat: Factory-formulated acrylic undercoat for exposed roof structure, roof deck, piping and ducting that has not been shop primed.
   1. Sherwin-Williams: Waterborne Acrylic Dry Fall, B42 Series.

2.7 INTERIOR FINISH COATS

A. Reference Schedule Information in Part 3 for specific usage of each paint system.

B. Interior Low-VOC Latex Enamel: Factory-formulated acrylic-latex interior enamel.
   1. Sherwin-Williams; Pro Mar 200 Zero VOC Latex Enamel: Applied at a dry film thickness of not less than 1.7 mils per coat. Gloss, semigloss, and eggshell/satin as scheduled.

   2. Sherwin-Williams; Pro Industrial Zero-VOC Acrylic Semigloss, B66W651 over shop primer: Applied at a dry film thickness of 2.5 – 4.0 mils per coat. Where specifically indicated for industrial finish.

C. Interior Dryfall Finish Coat: Factory-formulated acrylic finish coat for exposed roof structure, roof deck, piping, ducting, and cementitious wood fiber planks, both unprimed and primed.
   1. Sherwin-Williams: Waterborne Acrylic Dryfall, B42 Series.

D. Urethane Alkyd Enamel: Factory-formulated full-gloss urethane alkyd enamel for interior application.
   1. Sherwin-Williams; Industrial Urethane Alkyd Enamel, B54E51: Applied at a dry film thickness of 2.0 – 4.0 mils per coat.

E. Interior Semigloss Epoxy: Factory-formulated, two-component, waterbased, catalyzed epoxy resin for high performance applications.
   1. Sherwin-Williams: Waterbased Catalyzed Epoxy B70-200 Series: Applied at a dry film thickness of not less than 2.5 mils per coat.

2.8 INTERIOR WOOD STAINS AND LACQUERS

A. 250 VOC Interior Wood Stain: Factory-formulated penetrating wood stain for interior application, 250 g/L VOC. Use where stain or color is specifically indicated, and verify with Architect:
   1. Sherwin-Williams; Wood Classics Interior Oil Stain-250.

B. Interior Waterborne Polyurethane Varnish: Factory-formulated clear varnish, Gloss or Satin.
   1. Sherwin-Williams; Wood Classics Waterborne Polyurethane Varnish, A68 Series: Applied at a dry film thickness of 0.8 - 1.0 mils per coat. Satin finish unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive Work as instructed by product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Plaster and Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
   3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors: 8 percent.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and re-prime.
   2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
      c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

   3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
      a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
      b. Back-prime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.

   4. Ferrous Metals: 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's recommendations.
      a. Blast steel surfaces clean as recommended by paint system manufacturer and

according to SSPC-SP 10/NACE No. 2.

b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

6. Painted Surfaces: When painting over surfaces that have been previously painted, prepare surfaces in accordance with paint manufacturer's instructions, and verify with manufacturer that new coatings are compatible with the existing coatings.
   a. Provide adhesion testing of existing paint. Remove completely any loose, flaking, or non-adhering paint.
   b. Clean existing finishes of grease, oil, dust or other materials that may tend to adversely affect adhesion of new paint. Do not use cleaners that will leave a residue.
   c. Remove by sanding any gloss or sheen on existing painted surfaces before application of paint. Remove all sanding dust.
   d. Apply an alkyd bonding primer to all prepared existing painted surfaces prior to application of new paint. Use manufacturer's recommended epoxy primer for new epoxy painting. Verify proper primer for the specific application with the finish paint manufacturer and submit to the Architect.
   e. Where encountering existing no-sheen finishes, primer may not be required if preparation of existing surfaces will produce sufficient bonding of new paint, as demonstrated to the Architect through industry standard pull testing.

7. If specified new coating is determined to be incompatible with exiting coatings, do not proceed, and notify Architect for direction.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
   3. Provide finish coats that are compatible with primers used.
   4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, 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.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, non-specular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding coat and clean with tack-cloth.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.
4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
1. Switchgear.

2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Owner reserves the right to test installed work at any time and as often as Owner deems necessary during the period when paint is being applied:
1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

C. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 SCHEDULE - EXTERIOR SURFACES

A. Scheduling of paint types below is a general reference for the Project. Where specific paint types on the Color/Finish Schedule in the drawings vary from below, the Color/Finish Schedule shall govern

B. Concrete and Plaster (other than acrylic-finished plaster to remain unpainted):
   1. Low-Luster Acrylic Finish: Two finish coats over specified primer.
      a. Primer: Specified exterior concrete and masonry primer.
      b. Finish Coats: Specified exterior low-luster acrylic paint.
   2. Fire Lane Curbs and other Curb Painting:
      a. Primer: Not required.
      b. Finish Coats: 2-coats specified fire lane curb paint.

C. Concrete Unit Masonry (standard CMU as used for backs of masonry site walls): Provide the following finish system over exterior concrete masonry:
   1. Elastomeric Paint: Reference separate section number09 96 53
   2. Two finish coats over specified block filler.
      a. Block Filler: Concrete unit masonry block filler.
      b. Finish Coats: Elastomeric paint.

D. Metals: Provide the following finish systems over exterior galvanized or non-galvanized metal surfaces indicated to be painted:
   1. Steel doors and frames, railings, steel masonry lintels, steel stairs:
      a. Two coats specified urethane alkyd enamel over specified primer or shop primer.
   2. Miscellaneous piping, bollards, equipment supports indicated to be painted and not scheduled as urethane alkyd:
      a. Primer: Specified exterior metal primer.
      b. Finish Coats: Two coats specified exterior full-gloss alkyd enamel.
   3. Field Welds and Cuts on Galvanized Metal: Apply 2-coats of specified zinc-rich coating over wire-brushed and cleaned galvanized metal.

3.8 SCHEDULE - INTERIOR SURFACES (EXCEPT EPOXY)

A. Scheduling of paint types below is a general reference for the Project. Where specific paint types on the Color/Finish Schedule in the drawings vary from below, the Color/Finish Schedule shall govern.

B. Concrete (other than concrete masonry units): Provide the following paint systems over interior concrete:
   1. Primer: Specified interior concrete and masonry primer.
   2. Finish Coats: Interior low-VOC acrylic enamel.
      a. Semigloss finish in Classrooms and Laboratories.
      b. Eggshell/satin finish elsewhere unless otherwise scheduled.

C. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry units, except where scheduled for epoxy:
   1. Block Filler: Specified concrete unit masonry block filler.
   2. Finish Coats: 2-coats specified interior low-VOC latex enamel.
      a. Semigloss finish in Classrooms and Laboratories.
      b. Eggshell/satin finish elsewhere unless otherwise scheduled.

D. Gypsum Board Partitions: Provide the following finish systems over interior gypsum board partitions (unless otherwise scheduled):
   1. Primer: Specified interior gypsum board primer.
   2. Finish Coats: 2-coats specified interior low-VOC latex enamel.
      a. Semigloss finish in laboratory and prep.rooms, restrooms, custodial closets, wet areas.
      b. Satin finish in classrooms and corridors.
      c. Flat finish (lback) at “Black Box” theater room.

E. Gypsum Board Ceilings and Furrings: Provide the following finish systems over interior gypsum board ceilings and furrings in dry or normal humidity areas:
1. Eggshell/Satin: Zero-VOC Latex Enamel Finish: Two finish coats over specified primer.
2. Primer: Interior gypsum board primer.
3. Finish Coats at typical dry or low humidity areas: 2-coats specified interior Eggshell/Satin low-VOC latex enamel.
4. Finish Coats in wet or high humidity areas: 2-coats specified interior Semigloss low-VOC latex enamel.

F. Metals: Provide the following finish systems over exterior galvanized or non-galvanized metal surfaces indicated to be painted:
1. Stair treads, risers, and stringers; railings; other items specifically indicated for urethane alkyd enamel.
a. Two coats specified urethane alkyd enamel over specified primer or shop primer.
2. Miscellaneous piping, bollards, equipment supports; loose lintels.
a. Primer: Specified metal primer or shop primer.
b. Finish Coats: Two coats specified exterior full-gloss alkyd enamel.
3. Field Welds and Cuts in Galvanized Metals: Apply 2-coats of specified zinc-rich coating over wire-brushed and cleaned galvanized metal.
4. Removable door mullions and wall hanger brackets: Spray apply satin black enamel to all surfaces of removable mullions (steel or aluminum), as well as their respective wall hanging brackets.
5. Metals with intumescent paint: Coordinate with intumescent paint manufacture.

G. Exposed roof structure and roof deck (including piping, conduit, etc.): provide the following finish systems:
1. Undercoat: Specified interior dryfall paint.
2. Finish coat: Specified interior dryfall paint.

3.9 SCHEDULE - INTERIOR EPOXY COATINGS

A. Scheduling of paint type below is a general reference for the Project. Where specific paint types on the Color/Finish Schedule in the drawings vary from below, the Color/Finish Schedule shall govern

B. Concrete Unit Masonry or Concrete: Provide the following epoxy system over interior concrete masonry or rubbed concrete:

1. Semigloss Epoxy Finish: Two finish coats over specified primer.

a. Block Filler: Concrete unit masonry block filler.

b. Finish Coats: 2-coats specified interior water based semigloss epoxy finish.

C. Gypsum Board: Provide the following epoxy systems over interior gypsum board surfaces:
1. Semigloss Epoxy Finish: Two finish coats over specified primer.
a. Primer: Specified high performance gypsum board primer.
b. Finish Coats: 2-coats specified interior water based semigloss epoxy finish.

3.10 SCHEDULE - INTERIOR TRANSPARENT COATINGS

A. Transparent Finished Woodwork: Provide the following catalyzed lacquer system over wood surfaces:
1. Stain Coat: Specified interior oil wood stain where specifically indicated. Provide 1 or 2 coats as required to achieve selected uniform color.
2. Finish Coats: 2-coats specified interior polyurethane satin finish.
3. Lightly sand between all coats for best adhesion. Wipe with tack-cloth.

END OF SECTION

SECTION 09 96 53 - ELASTOMERIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. This Section includes surface preparation and application of elastomeric coatings to exterior surfaces as indicated.
2. Included is inside CMU face of freestanding courtyard walls, exterior face of single-wythe walls, and other areas as may be indicated.

B. Related Sections:
1. Section 09 96 53 – Elastomeric Coatings.

1.2 PERFORMANCE REQUIREMENT

A. Provide elastomeric coating systems with the following properties as determined by the test methods indicated:

B. Elongation at Break: Not less than 280 percent at 77 deg F and not less than 50 percent at 0 deg F according to ASTM D 412.

C. Low-Temperature Flexibility: Passes a 1/8 inch, 180 degree mandrel bend at minus 15 deg F at 20 mil dry film thickness according to ASTM C 711.

D. Water-Vapor Transmission: Not less than 2.0 perms according to ASTM E 96.

E. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555.

F. Minimum Solids Content by Volume: Not less than 45 percent.

1.3 SUBMITTALS

A. Product Data: For each elastomeric coating system specified. Include block fillers and primers.
1. Material List: An inclusive list of each required coating material. 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 and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by elastomeric coating manufacturer that products supplied comply with local regulations controlling use of VOCs.

B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative samples of 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. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
3. Submit samples on the following substrates for the Architect's review of color and texture only:
a. Concrete, Masonry, and Stucco: Provide two 4 inch (100 mm) square samples of actual substrate material for each color and texture.
b. Concrete Masonry: Two 8 inch (200 mm) square samples of concrete masonry, with mortar joint in the center, for each color and texture.

C. 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.

D. Product Test Reports: From a qualified independent testing and inspecting agency indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last 2 years of current product formulations.

E. Material Certificates: In lieu of agency test reports, when permitted by the Architect, certificates signed by manufacturers certifying that each material complies with requirements specified.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed coating system applications similar in material and extent to those indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and other undercoat materials from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide full-coat benchmark finish samples of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared Samples. Benchmark finish shall be applied by the Subcontractor responsible for the Project Work.
   1. The Architect will select one exterior wall surface to represent surfaces and conditions for each substrate.
      a. Wall Surfaces: Prepare benchmark samples on at least 100 sq. ft. of wall surface.
   2. After benchmark samples are approved, these surfaces will be used to evaluate coating systems.
   3. Obtain the Architect's approval of benchmark samples before starting application of coatings.
   4. Final approval of colors will be from benchmark samples, not samples submitted for verification.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in manufacturer's original, unopened packages and containers bearing the manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Manufacturer's stock number and date of manufacture.
   3. Contents by volume, for pigment and vehicle constituents.
   4. Thinning instructions (if permitted).
   5. Application instructions.
   6. Color name and number.
   7. Handling instructions and precautions.
   8. VOC content.

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 of coatings in a clean condition, free of foreign materials and residue.
   1. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.6 PROJECT CONDITIONS

A. Temperature Conditions: Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 deg F, unless otherwise permitted by manufacturer's written instructions.

B. Weather Conditions: Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or 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 starting or continuing coating operation.

1.7 WARRANTY

A. Elastomeric Coating Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace elastomeric coatings that fail within the specified warranty period. Failures include, but are not limited to, water penetration through the coating.

B. Warranty Period for Elastomeric Coatings: 5 years from the date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra elastomeric coating materials from the same production run as the materials applied in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
   1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. or 1 case, as appropriate, of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide one of the products for each condition indicated in the Coating Schedule, or a comparable product by other manufacturer.

B. Manufacturers Names: The following manufacturers are referred to in the Coating Schedule by use of shortened versions of their names, which are shown in parentheses:
   1. BASF Construction Chemicals (Sonneborn), www.buildingsystems.basf.com
   2. BASF Construction Chemicals (Thoro), www.buildingsystems.basf.com
   3. Kelly-Moore Paints (Kelly-Moore), www.kellymoore.com
   4. PPG Industries, Inc. (PPG Pittsburgh Paints), www.pittsburghpaints.com
   5. Tamms Industries Company (Tamms), www.tamms.com

2.2 CRACK FILLERS

A. Crack Fillers: Provide the manufacturer's standard factory-formulated acrylic emulsion crack fillers that are compatible with substrate and finish coat materials indicated.

B. Products: Subject to compliance with requirements, crack fillers that may be incorporated in the Work include, but are not limited to, the following:
   1. For cracks up to 1/16 inch, provide the following:
      a. Kelly-Moore: 1116 Kel-Seal Brush Grade.
      b. PPG Pittsburgh Paints: Perma-Crete 4-1002/4-1003 Brush Grade.
      c. Sonneborn: Hydrocide 750 Brush Grade or Knife Grade Patching Compound.
      d. Thoro: Thorolastic Knife Grade.
   2. For cracks more than 1/16 inch, provide the following:
      a. Kelly-Moore: 1108 Kel-Seal Knife Grade.
      b. PPG Pittsburgh Paints: Perma-Crete 4-1002/4-1001 Knife Grade.

c. Sonneborn: Hydrocide 750 Knife Grade Patching Compound.
d. Tamms: Tamms Thin Patch.
e. Thoro: Thorolastic Knife Grade.

2.3 ELASTOMERIC COATING MATERIALS

A. Material Compatibility: Provide crack fillers, block fillers, primers, elastomeric finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide the manufacturer's best-quality elastomeric coating material complying with requirements of FS TT-C-555. Material containers not displaying manufacturer's product identification are not acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
2. Furnish manufacturer's material data and certificates of performance of proposed substitutions.

C. Colors and Textures: Provide custom colors and textures of the finished elastomeric coating system to match the Architect's samples.

D. Products: Smooth, factory-formulated, 100 percent acrylic elastomeric coatings:
1. Kelly-Moore: 1128 Kel-Seal Smooth Elastomeric Coating.
2. PPG Pittsburgh Paints: 4-110 Perma-Crete Pitt-Flex Elastomeric Coating Smooth.
3. Sonneborn: Hydrocide colorflex Waterproof Elastomeric Coating.
4. Tamms: Tammolastic Smooth Elastomeric Decorative and Protective Coating.
5. Thoro: Thorolastic Smooth Elastomeric Coating.
6. Primer: As recommended by the coating manufactuer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with the Applicator present, under which elastomeric coating systems will be applied for compliance with application requirements. Surfaces to receive elastomeric coatings must be thoroughly dry before coatings are applied.
1. Notify the Architect in writing of anticipated problems using coatings specified with substrates primed by others.
2. Begin application only after unsatisfactory conditions have been corrected and surfaces to receive coating are thoroughly dry.
3. Start of coating within a particular area will be construed as the Applicator's acceptance of surface conditions.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed 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 in each area, reinstall items removed, using workers skilled in trades involved.

B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.
1. Schedule cleaning and coating application so dust and other contaminates 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 the particular substrate conditions and as specified.
   1. Cementitious Surfaces: Prepare concrete, concrete masonry, stucco, and similar surfaces to receive elastomeric coatings. Remove efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar conditions by water blasting followed by a clear water rinse.
      a. Remove mildew and neutralize surfaces according to manufacturer's written recommendations before patching materials are applied.
      b. Roughen as required to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
      c. If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
      d. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
   2. Crack Repair: Fill cracks according to manufacturer's written recommendations before coating surfaces.
   3. Deep Hairline Cracks: Remove dust and dirt from around cracks. Remove mildew by sterilizing before filling. Apply manufacturer's recommended primer to cracks before patching. If shrinkage occurs after applying crack filler, apply additional filler material to cracks before initially applying elastomeric coatings.
      a. Cracks up to 1/16 Inch: Clean surface around cracks. Apply primer penetrating cracks as deeply as possible, overflowing crack 2 inches on each side. When primer is dry, apply manufacturer's recommended sealant, forced well into cracks using a brush, putty knife, or trowel. Smooth edges around cracks over primed area. Allow for sealant shrinkage when applying.
      b. Cracks up to 3/8 Inch: Open cracks to 1/4 to 3/8 inch wide and 1/8 inch deep. Clean cracks and surrounding area removing dust, dirt, and other impurities. Apply primer recommended by manufacturer with a brush to obtain uniform coverage and spread approximately 2 inches on each side of cracks. Fill cracks with manufacturer's recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.
   4. Material Preparation: Mix and prepare materials according to coating manufacturer's written instructions.
      a. Stir materials before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film that may form into material. Remove film and, if necessary, strain coating material before using.
      b. If manufacturer permits thinning, use only thinners recommended by manufacturer, and only within limits recommended by manufacturer.

3.3 APPLICATION

A. General: Apply elastomeric coatings to exposed surfaces indicated, according to manufacturer's written instructions.

B. Labels: Do not paint over UL, FM, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.

2. If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
3. 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 where application of another coat does not cause undercoat to lift or lose adhesion.

D. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for material being applied.
2. Rollers: Use professional-quality quick-release rollers of carpet, velvet back, or high-pile sheep's wool covers with a 1 to 1-1/4 inch nap as recommended by the manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for material and texture required.
4. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness as recommended by the manufacturer.
5. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment, building up film thickness of 2 coats in 1 pass.

E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Prime Coats: If recommended by the manufacturer, apply a primer to material being coated before applying finish coats.

G. Brush Application: Brush out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

H. Roller Application: Keep the cover wet at all times; do not dry roll. Work in sections. Lay on required amount of material, working material into grooves and rough areas; then level material, working it into surface.

I. Spray Application: Use spray equipment for application only when permitted by manufacturer's written recommendations and authorities having jurisdiction.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.

3.4 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the Project site.
1. After completing coating work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by the Architect. Leave in an undamaged condition.

B. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.
   1. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces.

3.6 COATING SCHEDULE

A. Concrete Masonry: Provide the following elastomeric coating systems over exterior concrete masonry surfaces indicated to receive elastomeric coating:
   1. Block Filler: Manufacturer's recommended, factory-formulated, masonry block filler applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils.
      a. Kelly-Moore: 521 Prime-N-Fill Heavy Duty Block Filler.
      b. PPG Pittsburgh Paints: 16-90 Pitt-Glaze Int/Ext Block Filler Acrylic Latex.
      c. Sonneborn: Colorflex Block Filler #749.
      d. Tamms: H/P Primer.
      e. Thoro: Super Quickseal Intermix with Thorosheen Tint Base.
   2. Primer: Factory-formulated primer, if recommended by manufacturer, applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils.
   3. First and Second Finish Coats: Each coat applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 7 mils per each coat.
      a. Kelly-Moore: 1128 Kel-Seal Smooth Elastomeric Coating.
      b. PPG Pittsburgh Paints: 4-110 Perma-Crete Pitt-Flex Elastomeric Coating Smooth.
      c. Sonneborn: Hydrocide colorflex Waterproof Elastomeric Coating.
      d. Tamms: Tammolastic Smooth Elastomeric Decorative and Protective Coating.
      e. Thoro: Thorolastic Smooth Elastomeric Coating.

END OF SECTION

SECTION 10 11 00 - VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fixed markerboards.
   2. Vinyl-faced tackboards. both fixed and sliding.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood grounds.

1.2 REFERENCES

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

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations, and special anchor details and accessories.

C. Product Data: Submit data on each type of visual display surface specified.

D. Samples:
   1. Submit two panels, 8-1/2 x 11 inches in size, illustrating materials, colors, and textures of each visual display system specified.
   2. Submit two 6-inch long sections of each piece of aluminum trim specified, illustrating profile, color, and texture.

E. Manufacturer’s Certificates: Certify that vinyl tackboard coverings comply with surface burning characteristics specifies.

1.4 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

A. Surface Burning Characteristics: Maximum 200/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Flame Resistant Fabric: Passes when tested in accordance with NFPA 701, Test 1 or Test 2.

C. Source Limitations: Obtain all visual display surfaces from a single manufacturer.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish 50-year manufacturer warranty for magnetic markerboards.

C. Warranty: Include coverage of markerboard surface from discoloration due to cleaning, crazing or cracking, staining, and failing to retain original writing and erasing qualities.

PART 2 - PRODUCTS

2.1 VISUAL DISPLAY BOARDS

A. Manufacturers:
1. American Visual Display Products, LLC. www.americanvisualdisplay.com
2. Best-Rite Chalkboard Co. www.bestrite.com
3. Claridge Products and Equipment, Inc. www.claridgeproducts.com
4. General Binding Corporation, www.GBC.com
5. Lemco, Inc. www.adplemco.com
6. New Line Products www.newlineproduct.com.
7. Platinum Visual Solutions www.pvsusa.com.
8. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Markerboards: Balanced, high-pressure-laminated, magnetic markerboards of 3-ply construction consisting of porcelain enamel face sheet, core material, and backing.
1. Face Sheet: 0.024-inch enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F.
a. Cover Coat: For magnetic markerboards, provide manufacturer's standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.
2. Panel Construction:
a. Particleboard core specified below is usually retained because it is the most dimensionally stable core material offered. It is also available in 7/16- and 3/4-inch (11- and 19-mm) thicknesses, depending on manufacturer.
b. Core: 3/8 inch thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.
c. Backing Sheet: 0.015-inch thick, aluminum-sheet backing.
d. Laminating Adhesive: Manufacturer's standard, moisture-resistant, thermoplastic-type adhesive.
e. Panel Thickness: Nominal 1/2".

B. Vinyl-Fabric-Faced Tackboards: Mildew-resistant, washable vinyl fabric complying with FS CCC-W-408, Type II, weighing not less than 13 oz./sq. yd., laminated to 1/4 inch thick cork sheet. Provide fabric with a flame-spread rating of 25 or less when tested according to ASTM E 84. Provide color and texture as scheduled or as selected from manufacturer's standards.
1. Backing for Fixed Boards: Factory laminate cork face sheet under pressure to 3/8-inch thick fiberboard backing.
2. Reinforced Backing for Sliding Boards: 3/8” Honeycomb core.

C. Sliding Systems: Sliding tackboard panel in normal position is adjacent to framed interior window. Tackboard will be used infrequently to slide over window, providing full window

coverage, and exposed slider track on adjacent wall..

1. Sliding Panel: Specified vinyl-faced tackboard panel laminated to 3/8” honeycomb core. overall thickness nominal 1/2”.
2. Frames: Provide custom 1-1/2 inch wide clear anodized box frames to match corridor window frames.
3. Panel Sizes: As indicated in the drawings.
4. Configuration(s) as indicated in the drawings

2.3 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062 inch thick extruded aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure. Where tackboards are combined with magnetic markerboards, chalk trays and map rails shall be continuous across width of combination unit.
   1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
   2. Marker Tray: Manufacturer's standard, continuous, box-type, aluminum tray with slanted front and cast-aluminum end closures for each markerboard.
   3. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:
      a. Display Rail: Provide continuous cork display rail, 2 inches wide, integral with map rail.
      b. End Stops: Provide one end stop at each end of map rail.
      c. Map Hooks: Provide 2 map hooks with flexible metal clips for every 48 inches of map rail or fraction thereof. Provide a minimum of 6 map hooks per classroom.
      d. Flag Holder: Provide two flag holders for each room.
      e. Spring Clips: Provide 4 spring clips per each room.
      f. Roller Brackets: Provide 2 roller brackets per each room.

B. Adhesives: Type used by manufacturer, waterproof.

C. Music Staff Lines: If indicated provide manufacturer’s permanently fused music staff lines where indicated or directed; 5 lines each staff with 1" between each line; 5" between each staff and 3" boarder at top and bottom; Line thickness 1/16".

2.4 FABRICATION

A. Magnetic Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
   1. Cut joints straight and true. Space joints symmetrically. Fit and match panels before shipment to provide a continuous, uniform writing surface.
   2. Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches in either direction of equal spacing. Allow 1/4 inch clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:
      a. Up to 16 feet, 1 panel.
      b. More than 16 feet but less than 32 feet, 2 panels.

B. Assembly: Provide factory-assembled chalkboard and tackboard units, unless field-assembled units are required.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.

3. Provide manufacturer's standard mullion trim at joints between chalkboards and tackboards.

2.5 FACTORY FINISHING

A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; white color.

B. Aluminum Frame, Chalk Rail, and Accessories: Class II clear anodized finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify internal wall blocking is ready to receive Work and positioning dimensions are as indicated on shop drawings.

3.2 INSTALLATION

A. Deliver and install visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, install in 2 or more pieces of equal length as acceptable to Architect. When installation requires delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Establish top of chalk rail and bottom of perimeter frame at height indicated on Drawings.

C. Secure units level and plumb.

D. Coordinate units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean units in accordance with manufacturer’s instructions.

END OF SECTION

SECTION 10 14 00 – GRAPHICS PANELS, PLAQUES, AND BUILDING LETTERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of signs:
   1. Room Identification plaques.
   2. Dimensional letters and numbers.
   3. Cast metal plaques.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 01 50 00 - Temporary Facilities: Temporary project identification signs.
   2. Section 10 14 26 - Post and Panel Signs: Freestanding exterior signs.
   3. Section 14 24 00 - Hydraulic Elevators: Elevator door jamb markings.
   4. Division 23 for labels, tags, and nameplates for mechanical equipment.
   5. Division 26 for labels, tags, and nameplates for electrical equipment.
   6. Division 26 for illuminated exit signs.

1.2 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
   1. Product data for each type of graphics panel and plaque specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
   2. Shop drawings:
      a. Drawings showing fabrication and erection of graphics panels. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
      b. Schedule of room identification plaques with information about each individual sign furnished, including, but not limited to: door number, room name and number, sign type, sign text, and sign illustration graphics.
         1) Schedule shall be prepared by contractor or supplier; schedule will not be furnished by Architect.
         2) Provide message list for each plaque required, including large-scale details of wording and lettering layout.
   3. For custom graphics panels anchored to permanent construction, provide installation drawings indicating size and type of stand-offs and anchors.

B. Templates:
   1. Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
   2. Furnish full-size rubbings for metal plaques.

C. Samples for initial selection of color, pattern, and texture:
   1. Plastic Sheets and Plastic Laminates: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

D. Samples for verification of color, pattern, and texture selected and compliance with requirements indicated:
   1. Plastic Sheets: Provide a sample panel not less than 8-1/2 inches by 11 inches for each panel color selected. Include a representative sample of the graphics film applied to the sample(s).
   2. Room Identification Panels: Provide full-size representative panel in the selected

color, finish, and graphics required. Sample panel may be used in project installation after approval.

3. Dimensional Letters: Provide full-size representative samples of each dimensional letter type required, showing letter style, color, and material finish and method of attachment. Sample letters may be used in project installation after approval.
4. Stand-Off Anchors: Submit one complete unit in selected size, configuration, and finish.

1.3 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

D. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.4 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers of Panel Signs:
   a. ABC Architectural Signing System.
   b. Allenite www.allenitesigns.com
   c. Andco Industries Corp. www.andco.com
   d. APCO Graphics, Inc. www.apcoline.com
   e. Architectural Graphic Products
   f. ASI Sign Systems, Inc. www.asisign.com
   g. Bayuk Graphic Systems, Inc.
   h. Best Manufacturing Company www.bestsigns.com
   i. Charleston Industries, Inc. www.cisigns.com
   j. DGS Corp.

k. Diskey Sign Corp. www.diskeysign.com
l. Environmental Graphic Systems, Inc. www.egs-signs.com
m. Modulex. www.modulex.com
n. Mohawk Sign Systems www.mohawksign.com
o. Poblocki & Sons, Inc. www.poblocki.com/home.html
p. South Texas Graphic Specialties, Inc.
q. Spanjer Brothers, Inc.
r. The Supersine Company
s. Vomar Products, Inc. www.vomarproducts.com

2. Manufacturers of Dimensional Letters:
a. Andco Industries Corp. www.andco.com
b. A.R.K. Ramos Manufacturing Company, Inc. www.arkramos.com
c. ASI Sign Systems, Inc. www.asisign.com
d. Gemini, Inc. www.signletters.com
e. Matthews International Corp. www.matthewsisd.com
f. Metal Arts. www.metalartslettersandplaques.com
g. Metallic Arts, Inc. www.metallicarts.com
h. The Southwell Company. www.southwellco.com
i. Spanjer Brothers, Inc.
j. Vomar Products, Inc. www.vomarproducts.com

3. Manufacturers of Cast Plaques:
a. Andco Industries Corp. www.andco.com
b. A.R.K. Ramos Manufacturing Company, Inc. www.arkramos.com
c. Gemini, Inc. www.signletters.com
d. Metal Arts. www.metalartslettersandplaques.com
e. OMC Industries, Inc. www.omc-bronze.com
f. The Southwell Company www.southwellco.com
g. Vomar Products, Inc. www.vomarproducts.com

2.2 MATERIALS

A. Room Identification Plaques - Provide custom laminated panels constructed of matte-finished clear acrylic with opaque color coating subsurface applied, or plastic laminate in selected color and finish:

1. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
a. Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested according to the requirements of ASTM D 1003.
b. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

2. Plastic Laminate Sheet: High Pressure Decorative Laminate: NEMA LD 3, GP50 or GP28 Color, pattern, and surface texture as selected by the Architect from laminate manufacturer’s full range of colors and finishes.

a. Manufacturers: Wilson Art, Formica, Nevamar, or Pionite.

3. Permanently laminate face panels to backing sheets of material and thickness indicated using the manufacturer's standard process.

4. Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
    a. Edge Condition: Square, unless otherwise indicated.
    b. Corner Condition: Round corners, unless otherwise indicated.
5. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors that are recommended by acrylic sheet or plastic laminate manufacturers for optimum adherence and color fastness.
6. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
7. Subsurface Copy: Apply copy to the back face of clear acrylic sheet forming the panel face by process indicated to produce precisely formed opaque images free from rough edges.
    a. Use reverse silk-screen process to print copy; overspray the copy with an opaque background color coating.
    b. Use Dupont Chromalin heat- and pressure-laminated photopolymer film system to form copy and background color.
    c. Manufacturer has the option of selecting either process indicated above, or using subsurface engraving process, as appropriate to the copy form and the economics of production.
8. Raised Copy: Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.
    a. Raised Copy Thickness: Not less than 1/32 inch.

B. Dimensional Letters and Numbers:

1. Cast Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects.
    a. Cast aluminum with clear anodized finish, in styles and heights as indicated.
    b. Depending on installation type cast lugs into the back or bottom of characters and tap to receive threaded mounting studs.
    c. Comply with requirements indicated for color, finish, style, and size.
2. Mounts
    a. Back-Mounted: Cast lugs into the back of characters and tap to receive threaded brass or stainless steel mounting studs for mounting to building walls.
    b. Free-Standing Mounted: Cast lugs into the bottom of characters and tap to receive threaded stainless steel mounting studs for bolting to continuous aluminum angle.
3. Letter Heights and Styles: As indicated.
4. Miscellaneous:
    a. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for

the color and finish indicated.

b. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

c. Anchors and Inserts: Use stainless steel anchors and inserts for exterior installations and where exposed to view. Use aluminum or brass studs let into back of letters for anchoring letters to masonry or concrete walls.

C. Cast Metal Plaques

1. Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish and with requirements shown for thickness, size, shape, and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish.

2. Basis of Design: Style AL-300 as manufactured by A.R.K. Ramos and distributed locally by South Texas Graphics, Inc.
   a. Base Plaque: Cast aluminum, 24”W x 18”H x ¾”D.
   b. Border: None.
   c. Edge: Square.
   d. Background Texture: Manufacturer's standard leatherette finish.
   e. Background and Edge Finish: Baked-enamel black color.
   f. Raised Letters and Characters: Satin aluminum natural color.

2.3 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

2. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl-covered

surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.

3. Shim Plate Mounting: Provide 1/8-inch-thick concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.

4. Where plaques are mounted on glass and are visible from back side, provide same-size, same-color blank plate on opposite side of glass.

C. Individual Dimensional Letters and Numbers:

1. Freestanding Characters: Mount using threaded stainless steel studs set in tapped lugs at bottom of letters and shop-bolted to continuous anodized aluminum support plate. Alternate mounting using heli-arc welding prior to anodizing.

   a. Continuous Support: Bolt continuous aluminum angle supports to top of masonry walls using stainless steel expansion anchors.

   b. For security spot weld bolt heads to mounting angle.

2. Back-Mounted Characters: Mount using threaded stainless steel or brass studs set in tapped lugs at backs of letters. Drill holes in finished masonry slightly larger than threaded studs and set in two-component clear epoxy adhesive. Use sufficient epoxy such that small amount of material pushes out of the mounting holes and seals to back of letters or spacers.

D. Custom Graphics Panels:

1. Mount manufacturer’s brass mounting stud to steel frame structure using 1/4” bolt with machine threads or self-cutting threads for steel. Pre-drill hole in steel structure sized for self-cutting threads or drilled and tapped for machine threads.

2. Mount threaded stand-off barrel onto fixed threaded brass stud.

3. Locate stand-offs as indicated in the drawings, nominal 24” o.c. each way.

4. Secure graphics panels to stand-off barrels by installing threaded cap into barrel. If barrel has no set screw, provide epoxy coating of nominal 1/2” of threads prior to installing cap.

E. Cast Metal Plaques: Mount plaques using one of the following methods dependent on substrate.

1. Concealed Mounting in Masonry: Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.

2. Mounting in Drywall: Coordinate with Contractor for installation of solid wood blocking between studs for mounting of plaque. Use countersunk, flat-head, square-drive stainless steel mounting screw in each corner.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10 14 26 - POST AND PANEL SIGNS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-illuminated single-panel-type post and panel signs.

B. Related Sections:
   1. Section 01 50 00 - Temporary Facilities: Temporary project identification, information, and directional signs.
   2. Section 03 30 00 - Cast-In-Place Concrete: Concrete fill for post holes.
   3. Section 10 14 00 - Signs: Wall-mounted interior signs.

1.2 SUBMITTALS

A. Product Data: For each type of post and panel sign specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide manufacturer's written instructions for maintaining and cleaning sign surfaces.

B. Shop Drawings: For each type of post and panel sign indicated.
   1. Provide plans, elevations, and at least 3/4-inch (1:20) scale sections of typical members and other components. Show anchors, reinforcement, accessories, layout, and installation details.
   2. Provide message list, including details of wording and lettering layout, at least half size. Include full-size details of special graphics.
   3. Provide detail of break-away bolted base.

C. Samples for Verification: Of the following products, showing color, texture, or finish selected. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected. Prepare Samples from the same material to be used for the Work.
   1. Aluminum: Samples of each finish type and color, on 6-inch long sections of extrusions and squares of sheet or plate at least 4 inches.
   2. Include a representative sample of the graphic-image process required in each panel. Show graphic style and colors and finishes of letters, numbers, and other graphic devices.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sign manufacturer and who has completed installation of post and panel signs similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain post and panel signs through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of post and panel signs and are based on the specific type and model indicated. Other manufacturers' signs may be considered provided deviations are minor and do not change the design concept and are approved by the Architect.

D. Do not modify intended aesthetic effects, as judged solely by the Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.4 DELIVERY AND HANDLING

A. Delivery: Provide protective covering or crating as recommended by the manufacturer to protect sign components and surfaces against damage during transportation and delivery.
   1. Coordinate delivery time so signs can be installed within 24 hours of receipt at Project site.

B. Handle signs carefully to prevent breakage, surface abrasion, denting, soiling, and other defects. Comply with the manufacturer's written handling instructions for unloading components subject to damage.
   1. Inspect sign components for damage on delivery.
   2. Do not install damaged sign components.
   3. Repair minor damage to signs, provided the finished repair is equal in all respects to the original work and is approved by Architect; otherwise, remove and replace damaged sign components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Apco Graphics Inc., www.apcosigns.com.
   2. ASI Sign System, Inc., www.asisign.com
   3. Charleston Industries, Inc., www.cisigns.com.
   4. Vomar Products, Inc., www.vomarproducts.com.

2.2 MATERIALS

A. Aluminum Sheet or Plate: Alloy and temper recommended by the aluminum producer and finisher for the type of use and finish indicated, and with at least the strength and durability properties specified in ASTM B 209 (ASTM B 209M) for 5005-H15 alloy.

B. Aluminum Extrusions: Alloy and temper recommended by the aluminum producer and finisher for the type of use and finish indicated, and with at least the strength and durability properties specified in ASTM B 221 (ASTM B 221M) for 6063-T5 alloy.

C. Vinyl Film: Opaque, non-reflective vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior applications.

D. Colored Coatings for Plastic Sheet: Use nonfading colored coatings, including inks and paints for copy and background colors that are recommended by the manufacturers for optimum adherence to the type of surface used.

2.3 COMPONENTS

A. Aluminum Posts: Manufacturer's standard 0.125-inch thick, structural aluminum tubing extruded from 6063-T5 alloy, with vertical slots to engage sign panels. Provide stop blocks in slots to hold panels in position. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for a complete installation. Comply with the following requirements for post shape, finish, and mounting method:
   1. Post Shape: 2 by 2 inches square.
   2. Post/Frame Finish: Clear anodized aluminum.
   3. Post Mounting Method:
      a. Unpaved areas: Provide sign posts of length required for permanent installation by direct-burial mounting method.
      b. Paved areas: Provide break-away mounting detail as indicated in the drawings.

B. Sign Panels: Provide smooth, even, level 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.

1. Framed Single-Sheet Panels: Provide framed single-sheet sign panels with edges mechanically and smoothly finished to conform to the following:
   a. Panel Material: 0.125-inch thick aluminum plate.
   b. Panel Finish: Baked enamel.
2. Frame Material: Extruded aluminum, fabricated to profile indicated with integral slots to receive sign message panel; comply with the following:
   a. Frame Finish: Clear anodized aluminum.
   b. Corner Condition: Square corners.

C. Graphic Content and Style: Provide sign copy to comply with requirements indicated for sizes, styles, spacing, content, positions, materials, finishes, and colors of letters, numbers, symbols, and other graphic devices.

1. Surface-Applied, Die-Cut Vinyl Copy: Provide die-cut characters from nonreflective vinyl film with pressure-sensitive adhesive backing. Apply copy to exposed face of sign panel.

2.4 ACCESSORIES

A. Fasteners: Use concealed fasteners fabricated from metals that are noncorrosive to sign material and mounting surface.

B. Anchors and Inserts: Use nonferrous metal or hot-dip galvanized anchors and inserts. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete.

2.5 FABRICATION

A. General: Provide manufacturer's standard double-post, single-panel-type post and panel signs. The completed sign assembly shall consist of a message panel supported between 2 posts. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Allow for thermal movement resulting from a maximum ambient temperature change (range) of 100 deg F. Design, fabricate, and install post and panel sign assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners.
   a. Base design on actual surface temperatures of metals due to both solar heat gain and nighttime-sky heat loss.
2. 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 on exposed and contact surfaces.
3. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.
4. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.
5. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

B. Posts: Fabricate posts to lengths required for mounting method indicated.

1. Direct Burial Type: For permanent sign installation in non-paved area, provide posts 36 inches longer than height of sign to permit direct embedment in concrete foundations.
2. Break-Away Type: For sign installations within paved areas, provide break-away type base for posts that will protect paved areas in the event of impact.

C. Panels: Form panels to required size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

1. Increase metal thickness or reinforce with concealed stiffeners or backing materials as required to produce surfaces without distortion, buckles, warp, or other surface deformations.
2. Continuously weld joints and seams, unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.

D. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8, except with a minimum dry film thickness of 1.5 mils, medium gloss.

E. Color: As indicated by manufacturer's color designations.

F. Colors and Textures: For exposed sign material that requires selection of materials with integral or applied colors, textures, or other characteristics related to appearance, provide color matches as selected by Architect from manufacturer's standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of type described and complying with manufacturer's written instructions.

B. Excavation: In firm, undisturbed or compacted soil, drill or (using a post-hole digger) hand-excavate holes for each post to the minimum diameter recommended by sign manufacturer, but at least 4 times the largest post cross-section.

C. At unpaved areas excavate hole depths approximately 3 inches (75 mm) lower than required post bottom, with bottom of posts set at least 36 inches (900 mm) below finished grade.

D. At paved areas provide concrete footing with break-away mounting as indicated in the drawings.

E. Install signs level, plumb, and at height indicated, with surfaces free from distortion or other defects in appearance.

3.2 CLEANING AND PROTECTING

A. At completion of installation, clean soiled surfaces of sign units according to manufacturer's written instructions.

B. Protect installed sign units from damage until acceptance by Owner.

END OF SECTION

SECTION 10 21 15 – SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Solid plastic toilet compartments and urinal screens, overhead braced.

1.2 REFERENCES

A. ASTM International:
1. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, and door swings.

C. Product Data: Submit data on panel construction and each type of hardware and accessory.

D. Samples: Submit two samples, 12 x 12 inch in size, illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Texas Accessibility Standards (TAS).

PART 2 - PRODUCTS

2.1 SOLID PLASTIC TOILET COMPARTMENTS

A. Manufacturers:
1. Accurate Partitions Corporation www.accuratepartitions.com
2. Ampco www.ampco.com
3. General Partitions Mfg. Corp. www.genpartitions.com
4. Metpar Corp., www.metpar.com.
5. Nevco www.nevco.com
6. PSISC (Columbia Partitions), www.psisc.com.
7. Scranton Products (Santana/Comtec/Capitol) www.scrantonproducts.com
8. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Floor mounted and overhead braced.

2.2 COMPONENTS

A. Door, Panel and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.
1. Color and Pattern: One color and pattern in each room as selected from manufacturer’s full range of colors and patterns.

B. Urinal Screens: Floor-mounted and wall-braced, of same material as toilet compartments. Brace with 2” x 2” x 1/8” thickness clear anodized extruded aluminum tube with concealed stainless steel or aluminum floor mounting plate and bolted and braced to

building structure above ceiling.

2.3 ACCESSORIES

A. Pilaster Shoe: Formed stainless steel sheet, ASTM A666 Type 304, with No. 4 finish; 3-inch high; concealed floor fastenings.

B. Head Rails: Hollow extruded aluminum tube with anti-grip profile and cast socket wall brackets; clear anodized finish.

C. Brackets: Polished stainless steel or solid plastic, full-height (continuous) type.

D. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum strip fastened to exposed bottom edges of solid-polymer components to prevent burning.

E. Attachments, Screws, and Bolts: Stainless steel or chrome plated steel or brass, tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.

F. Hardware: Stainless steel:
1. Full-length piano hinge, self-closing, adjustable to hold door open at any angle up to 90-degrees.
2. Thumb turn door latch with exterior emergency access feature; at compartments indicated to be handicapped accessible, provide latches that comply with accessibility requirements of authorities having jurisdiction.
3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
4. Coat hook with rubber bumper; one for each compartment, mounted on door.
5. Furnish door pull and rubber-tipped bumper for out-swinging doors. Provide pulls on both sides of doors at compartments indicated to be handicapped accessible.
6. Furnish continuous channel brackets at walls.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Doors:
1. Standard Compartments: Provide 24-inch wide in-swinging doors unless indicated otherwise.
2. Handicapped Accessible Compartments: Provide 34-inch wide out-swinging doors with a minimum 32 inch wide clear opening.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Maintain the following maximum clearances:
1. Walls and panels: 1 inch.
2. Walls and pilasters: 1 inch.
3. Panels and pilasters: 1/2 inch.

B. Attach continuous panel brackets securely to walls using anchor devices.

C. Secure pilasters to floor; level, plumb, and tighten.

D. Secure continuous head rail to each pilaster with not less than two fasteners.

E. Hang doors to align tops of doors with tops of panels and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

F. Urinal Screens: Attach to floors and walls with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Indicated Position: 1/4 inch.

C. Maximum Variation From Plumb: 1/8 inch.

END OF SECTION

SECTION 10 26 41 – BALLISTIC-RESISTANT FIBERGLASS PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Specialized fiberglass panels concealed within other construction to provide bullet-resistance equal or better than the specified testing standard.

B. Related Sections:
   1. Section 06 20 23 – Interior Finish Carpentry and Millwork: Wood or plastic laminate surfaced millwork indicated to receive bullet-resistant protection.
   2. Section 09 21 16 – Gypsum Board Assemblies: Drywall assemblies indicated to receive bullet-resistant protection.

1.2 REFERENCES

A. Underwriters Laboratories
   1. UL 752 Specifications and Ammunition, 11th Edition, Standard for Bullet Resisting Equipment published September 9, 2005, revised December 21, 2006.

B. American Society for Testing and Materials (ASTM International)
   1. ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product and testing data in sufficient detail to indicate compliance with these specifications and the referenced testing standard.

C. Installation Instructions: Submit manufacturer’s recommended installation instructions showing all requirements for blocking, bracing, and joint protection as required to maintain specified bullet-resistance Level per the testing standard.

D. Samples: Submit samples, nominal 6 x 6 inches in size, of proposed material in thickness as required to meet specified bullet-resistance Level per the testing standard.

E. Shop drawings:

   1. Show location and extent of bullet-resistant fiberglass panels. Include plans, elevations, large-scale details of fastenings and any required accessory items. Indicate typical and special details.
   2. Indicated requirements for treatment of panel joints to maintain specified bullet-resistance Level per the testing standard.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver the materials to the project with the manufacturer’s UL LISTED Labels intact and legible.

C. Handle the material with care to prevent damage. Store the materials inside under cover, stack flat with full support and off the floor.

D. Protect panels specialties before, during and after installation. Protect installed work of other trades.

1.5 WARRANTY

A. Contractor's Warranty: Materials and workmanship shall be warranted against defects for a minimum period of one-year after Substantial Completion of the Project. Defects shall include failure to achieve or maintain specified protection level.

B. Manufacturer's Warranty: Provide manufacturer's written warranty against defects in materials for a minimum period of two-years after Substantial Completion of the Project. Defects shall include failure to achieve or maintain specified protection level.

1.6 PERFORMACE CRITERIA

A. Bullet-resistant fiberglass panels shall be "non ricochet type" to permit the capture and retention of an attacking projectile lessening the potential of a random injury or lateral penetration.

B. Panel Bullet-Resistance Rating: **Level 3** per UL 752.
1. Panel Fire-Resistance Rating: As required by drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armorcore (Waco Composites, Ltd.) , www.armorcore.com

B. Gaffco Ballistics, www.gaffco.com

C. Insulgard Security Products, www.insulgard.com

D. Substitutions: Section 01 60 00 - Product Requirements

2.2 BASIS OF DESIGN

A. Insulgard *FG Series Fiberglass-Reinforced Structural Polyester Laminate* or approved equivalent by specified manufacturer.

B. Material

1. Panels fabricated of multiple layers of woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets.

2. Panel Sizes:
   a. Face Size(s): Manufacturer's standard panel size(s) as required by installer for most efficient use of material and least number of panel joints for the particular installation.
   b. Thickness: As required to meet specified ballistics-resistant rating

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting installation verify that the related work of other trades is satisfactory for the proper installation of bullet-resistant fiberglass panels.

B. Notify the Architect and General Contractor in writing of any apparent conditions detrimental to the proper installation of bullet-resistant fiberglass panels. Do not proceed with installation until all such discrepancies have been resolved. Beginning installation of panels indicates acceptance of substrate and construction by other trades.

3.2 INSTALLATION

A. For installation use only personnel who are skilled in the work required and approved by the

panel manufacturer for the particular Project.

B. Mechanically fasten panels in a concealed behind finish materials in accordance with manufacturer's printed instructions, as indicated in the drawings, the approved shop drawings, and as required to maintain the specified bullet-resistant level.

1. Where indicated standard fastening methods of finish materials over bullet-resistant panels will be sufficient to hold panels permanently in place, adhesive approved by the panel manufacturer may be used in lieu of mechanical fastening of panels.

C. Reinforce panel joints with a back-up layer of bullet-resistive panel material in same thickness. Minimum width of reinforcing strip behind each joint shall be 4-inches, centered on panel joint, butted tight.

D. Install panels as necessary to reduce risk by fitting tightly to adjacent surfaces including floor slab, door and window frames, wall perimeters, and other adjacent construction.

END OF SECTION

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. The following items are Contractor furnished and Contractor installed:
   1. Sanitary napkin disposal units.
   2. Grab bars.
   3. Stainless steel framed mirrors.
   4. Mop and broom holders with integral shelf.

B. The following items are Owner-Furnished and Contractor Installed (OFCI):
   1. Surface-mounted paper towel dispensers.
   2. Surface-mounted toilet tissue dispensers.

C. The following items are Owner-Furnished and Owner Installed (OFOI):
   1. Surface-mounted soap dispensers.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

B. Product Data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, method of mounting, specified options, and finishes.

C. Schedule: Indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

D. Setting Drawings: Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

1.3 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.4 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

1.6 WARRANTY

A. Special Project Warranty: Provide manufacturer’s written 5-year warranty against silver spoilage of mirrors, agreeing to replace any mirrors that develop visible defects within warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:
   1. Toilet and Bath Accessories
      a. A & J Washroom Accessories www.ajwashroom.com
      b. American Specialties, Inc. www.americanspecialties.com
      c. Bobrick Washroom Equipment, Inc. www.bobrick.com
      d. Bradley Corporation www.bradleycorp.com
      e. Georgia-Pacific www.gp.com
      f. General Accessory Manufacturing Co. www.gamcousa.com
      g. Kimberly-Clark Professional www.kcprofessional.com
      h. McKinney/Parker

2.2 MATERIALS, GENERAL

A. Reference Toilet Accessory Schedule in drawings for specific model numbers.

B. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22-gage minimum thickness, unless otherwise indicated.

C. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16, Castings, ASTM B-30.

D. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 20-gage minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.

E. Galvanized Steel Sheet: ASTM A 527, G60.

F. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

G. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.

H. Vinyl-Backed Safety Mirror Glass: Nominal ¼ inch thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro- plated copper coating, and protective organic coating. Apply vinyl backing with pressure-sensitive adhesive coating over glass coating by method recommended by vinyl-backing manufacturer to produce a surface free of bubbles, blisters, or other imperfections. Use adhesives and vinyl backing compatible with glass coating as certified by organic coating manufacturer.

I. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

J. Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

K. Keys: Unless otherwise indicated, provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six (6) keys to Owner’s representative and obtain receipt.

2.3 SANITARY NAPKIN DISPOSAL UNITS

A. Surface-mounted stainless steel disposal unit with seamless exposed walls, tightly self-closing top cover and locking bottom panel with continuous stainless steel piano hinge.
   1. Basis-of-Design: Bobrick B270.

2.4 GRAB BARS

A. Stainless Steel Type: Provide grab bars with wall thickness not less than 18 gage and as follows:
   1. Mounting: Concealed, manufacturer's standard flanges and anchorages.

2. Clearance: 1-1/2 inches clearance between wall surface and inside face of bar.
3. Gripping Surfaces: Smooth, satin finish.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
5. Length: 42", at sides of water closet; 36", behind water closet.

2.5 FRAMED MIRRORS

A. Stainless Steel Framed Mirror Units: Fabricate frame with angle shapes of not less than 18 gage, with square corners mitered, welded, and ground smooth. Provide in No. 4 satin polished finish.

2.6 MISCELLANEOUS ACCESSORIES

A. Mop and Broom Holder: 18 gage Type 304 stainless steel unit with (4)spring-loaded rubber cam-type mop/broom holders and (4) rag hooks. Provide with integral stainless steel shelf full-length x minimum 8” deep with 3/4” return edges, all hemmed.
1. Basis-of-Design: Bobrick B-239 x 34.

2.7 FABRICATION

A. General: Only a maximum 1-1/2-inch diameter, unobtrusive stamped logo of manufacturer, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent accumulation of moisture. Provide galvanized steel backing sheet, not less than 22 gage and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror Unit Hangers: Provide system of mounting mirror units that will permit rigid, tamperproof, and theft-proof installation including heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring special tool to remove.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units in accordance with manufacturers' instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, in accordance with manufacturer's instructions for type of substrate involved.

C. Install grab bars to resist tensile and moment forces generated by a load of 250 lb. applied in any direction, or as otherwise required by authorities having jurisdiction, whichever is more stringent.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

SECTION 10 28 10 - MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous specialties, including:
   1. Clinic curtain and track.
   2. Wall corner guards.
   3. Exterior and Interior aluminum column covers.

1.2 QUALITY ASSURANCE

A. For installation use only personnel who are skilled in the work required.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each miscellaneous specialty and accessory specified.

C. Installation Instructions: Submit manufacturer's recommended installation instructions showing all requirements for blocking and bracing.

D. Samples: Submit samples of each finish material exposed to view, 6 x 6 inches in size, showing full range of colors and patterns.

E. Shop drawings: Show location and extent of miscellaneous specialty items. Include plans, elevations, large-scale details of anchorages, and accessory items. Indicate typical and special details.
   1. Changing Station: Provide drawings prepared by manufacturer showing location of steel support members within wall cavity for full support of changing station.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protection: Protect specialties before, during and after installation. Protect installed work of other trades.

C. Replacements: In event of damage, make necessary replacements.

PART 2 - PRODUCTS

2.1 CLINIC CURTAIN AND TRACK

A. Manufacturers
   1. ADC Hospital Equipment, www.automaticdevices.com
   2. Clickeze Cubicle Tracking System, InPro Corp., Muskego, WI 800-222-5556
   3. General Cubicle Company Inc., www.generalcubicle.com
   4. Graber Industries, Middleton, WI 800-356-9102
   5. Imperial Fastener Company, www.imperialfastener.com
   6. A. R. Nelson Co.
   7. Pryor Products, www.pryorproducts.com
   8. Salsbury Industries, www.mailboxes.com
   9. Substitutions: Section 01 60 00 - Product Requirements

B. Components

   1. Track: Extruded aluminum sections, not less than 1-1/4 inches wide by 3/4-inch high, with minimum wall thickness of 0.062 inch; one piece for each cubicle track run.

   2. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and

joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and finish as track.
   a. End Stop: Non-removable.

3. Curtain Carriers: Nylon roller to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; one carrier for each 6 inches of fabric width.

4. Wand: Aluminum or plastic hollow section, attached to lead carrier, for pull-to-close action.

5. Curtain:
   a. Fabric: Close weave 100 percent polyester; anti-bacterial, self-deodorizing, sanitized, preshrunk; inherently and permanently flame resistant; color as selected from manufacturer's standard range.
   b. Open Mesh Cloth: No. 50 nylon mesh to permit air circulation; flameproof.
   c. Curtain Grommets: Two-piece, rolled edge, rustproof, nickel-plated brass, machined into top hem.

6. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

7. Curtain Track: Hand-drawn ceiling mounted extruded aluminum curtain track in clear anodized finish. Provide 48" baton for hand operation and all slides and hardware required for a complete installation.

8. Curtain: Provide standard weight Class "A: polyester fabric curtain on each curtain track. Curtain shall be 10% wider than opening with flat panel, grommets at 6-inch centers, and 20-inches of open mesh along top. Bottom of curtain shall hang uniformly 6-inches above the floor.

9. Provide one curtain track and curtain at each cot location.

10. Basis of design: Model #9-994 as manufactured by Graber.

2.2 WALL CORNER GUARDS

A. Type: 16-ga. brushed finish Type 304 stainless steel, surface-mount type. Type AG-16-2 as manufactured by Metalines or approved equivalent by Boss.

B. Provide at outside corners of walls.

C. Size:
   1. Corridors: 2" x 2" x 4 ft. long from top of floor base.
   2. Food Service area: 2" x 2" x one-piece length from top of floor base to ceiling.

D. Fastening: Flat head stainless steel screws.

2.3 ALUMINUM COLUMN COVERS

A. Manufacturers:
   1. Centria, www.centriaperformance.com
   2. Fry Reglet Corporation, www.fryreglet.com.
   3. Gordon, www.gordon-inc.com.
   4. MM Systems Corporation, www.mmsystemscorp.com.
   5. Nelson Industrial Inc., www.nelsonindust.com.
   6. Pittcon Industries, www.pittconindustries.com.

B. Interior Floatable Type: Form column covers to shapes indicated from metal of type and minimum thickness indicated below:
   1. Basis-of-Design: Fry Reglet, Series FF or approved equivalent by specified manufacturer.

2. Material: Minimum 0.125 aluminum.
3. Configuration: Round; diameter(s) as indicated in the drawings. Provide white-finished ceiling trim ring at ceiling penetrations.
4. Vertical Joint Type: Flush monolithic designed for field applied tape and float finish provided under Section 09 21 16.
5. Horizontal Joints: Flush, with factory furnished alignment plates.
6. Internal Supports: Steel stud framing provided under Section 09 21 16.
7. Connectors: Provide concealed connectors for anchoring to structure above ceiling.
8. Final Finish: 2-coats semi-gloss enamel finish over specified primer provided under Section 09 90 00.

C. Exterior Factory-Finished Type: Form column covers to shapes indicated from metal of type and minimum thickness indicated below:
1. Basis-of-Design: Fry Reglet, Series E or KS, or approved equivalent by specified manufacturer.
2. Material: Minimum 0.125” thick formed aluminum sheet.
3. Configuration: Round; diameter(s) as indicated in the drawings. Provide matching top and bottom trim ring as required.
4. Vertical Joints: Tight hairline joint unless otherwise indicated.
5. Connectors: Provide manufacturer’s concealed 1/8” thick steel connector clips for anchoring to building column. Provide stainless steel or corrosion protection.
6. Factory Finish: Class I, clear anodic brushed #4 finish per AA-M12C22A41. Match approved sample.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review manufacturer’s installation instructions and notify Architect in the event of discrepancies or incompatibility with existing conditions; do not proceed with installation until all such discrepancies have been resolved.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and with requirements of authorities having jurisdiction.

B. Anchor specialties securely in place in accordance with manufacturer’s instructions.

C. Sequence installation to accommodate required utility connections.

D. Touch-up surfaces damaged during installation. Replace damaged components that cannot be satisfactorily repaired.

3.3 CLEANING

A. Section 01 71 00 - Execution and Closeout Requirements: Final cleaning.

B. Remove packing material from miscellaneous specialties and leave in clean condition, ready for operation.

END OF SECTION

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Portable fire extinguishers and extinguisher cabinets.
   2. Brackets for wall mounting fire extinguishers.
   3. Defibrillator Cabinets.
   4. Fire Department lock boxes.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking and shims.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 10 - Standard for Portable Fire Extinguishers.

B. Underwriters Laboratories Inc.:
   1. UL - Fire Protection Equipment Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

C. Provide fire rated cabinets classified and labeled by Underwriters Laboratories Inc. for purpose specified and indicated.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each product specified, submit operational features, color and finish, and anchorage details.
   1. Fire extinguishers: Include rating and classification.
   2. Cabinets: Include rough-in dimensions, mounting details, door hardware, cabinet type, and trim style.

C. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

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

B. Operation and Maintenance Data: Submit test, refill or recharge schedules and re-certification requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Manufacturers:
1. JL Industries, www.jlindustries.com.
2. Larsen's Manufacturing Co., www.larsensmfg.com.
3. Nystrom Products Co., www.nystrom.com.
4. Potter Roemer, www.potterroemer.com.
5. Substitutions: Section 01 60 00 - Product Requirements.

2.2 FIRE EXTINGUISHERS

A. Multipurpose Dry Chemical Type: Cast steel tank with pressure gage; 4-A:60-B:C, 10 lb capacity.

2.3 FIRE EXTINGUISHER CABINETS

A. Tub: Formed sheet steel, 0.036 inch thick base metal.

B. Doors and Trim: Formed stainless steel sheet.

C. Configuration: Semi-recessed type, sized to accommodate extinguisher.

D. Trim Type: Rolled-edge trim, returned to wall surface, with 4 inch projection.

E. Door: 0.016 inch thick, partially-glazed panel, reinforced for flatness and rigidity; with minimum 1/2 inch thick frame.

F. Door Glazing: Clear acrylic, 1/8 inch thick. Vertical clear acrylic window with white "FIRE EXTINGUISHER" decal.

G. Door Hardware: Manufacturer's standard door-operating hardware cam-action latch or door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

H. Cabinet Mounting Hardware: Appropriate to cabinet.

I. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim in one piece with corners mitered, welded, and ground smooth.

J. Pre-drill for anchors.

K. Weld, fill, and grind components smooth.

L. Glaze doors with resilient channel gasket glazing.

M. Finishing Tub and Interior: Baked enamel, color as selected.

N. Finishing Doors and Trim: No. 4 polished stainless steel.

2.4 FIRE-RATED FIRE EXTINGUISHER CABINETS

A. Where cabinets are indicated to be installed in fire-rated CMU walls, provided cabinets listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall.

B. Match construction of non-rated cabinets except as follows:
1. Construct fire-rated cabinets with double walls fabricated from 0.0478 inch thick, cold-rolled steel sheet lined with minimum 5/8 inch thick fire-barrier material.
2. Provide factory-drilled mounting holes.

2.5 AUTOMATED EXTERNAL DEFIBRILLATORS (AED) CABINETS

A. Basis of Design Product: Subject to compliance with requirements, furnish and install Model

AED Plus Combo Pack – Fully Automatic Unit by Zoll. No substitutions.

B. Type: Semi-Recessed with factory powder-coated cold rolled steel tub; white color.

C. Door: Anodized aluminum frame with vertical clear acrylic vision panel, continuous hinge, zinc plated handle, roller latch, and standard Automated External Defibrillator (“AED”) graphics in red color.

D. Alarm: Battery operated siren strobe and audible (85-db) alarm. Provide keyed on/off switch on cabinet exterior.

2.5 FIRE DEPARTMENT LOCK BOXES

A. Provide locking security box for fire department and other authority access to building, as required by local authorities. Coordinate specific requirements, including location requirements, with local authorities. Unless otherwise indicated or directed, provide security boxes or other devices as manufactured by Knox Company, Irvine, CA., www.knoxbox.com.

2.6 ACCESSORIES

A. Extinguisher Brackets: Formed steel, plated or baked enamel finish.
1. Furnish brackets for extinguishers mounted inside cabinets.
2. Furnish brackets for extinguishers not mounted inside cabinets.

B. Cabinet Signage: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
2. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
a. Application Process: Vinyl letters.
b. Lettering Color: White.
c. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install cabinets plumb and level in wall openings.

B. Install wall brackets to walls and cabinets at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Secure rigidly in place.

D. Place extinguishers on wall brackets.

E. Position cabinet signage as required by authorities having jurisdiction.

END OF SECTION

SECTION 10 51 13 - METAL WARDROBE LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fully-welded metal wardrobe lockers in Kitchen area.

B. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood grounds and attachment strips.
   2. Section 10 51 26 – Plastic Wardrobe Lockers

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate locker plan layout, and numbering plan.
   1. Show sloping tops, filler panels, trim, and other accessories.

C. Product Data: Submit data on locker types, sizes, and accessories.

D. Samples: Submit two samples, 3 x 6 inches in size, of each color selected, applied to specified base metal.

E. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain all metal lockers and accessories from a single manufacturer.

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect locker finish and adjacent surfaces from damage.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 COORDINATION

A. Coordinate size and location of concrete and concrete masonry 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.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Warranty: Manufacturer's standard form in which 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. Breakage.
      b. Structural failures.
      c. Corrosion.
      d. Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.
   3. Warranty Period: 10-years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish the following extra materials packaged with protective covering for storage and identified with labels describing contents:
   1. Identification plates.
   2. Hooks.

C. Furnish extra materials as listed above for 5 units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wardrobe Lockers – Kitchen Staff:
   1. DeBourgh Manufacturing Co. www.all-american-lockers.com
   2. ASI Storage Solutions www.asilockers.com
   3. General Storage Systems, www.generalstoragesystems.com
   4. List Industries, Inc. www.listindustries.com
   5. Lyon Metal Products, Inc. www.lyonmetal.com
   6. Penco Products, Inc. www.pencoproducts.com
   7. Republic Storage Systems Co. www.republicstorage.com
   8. WEC Manufacturing, www.itswec.com
   9. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS:

A. Sheet Steel: Mild, cold rolled and leveled unfinished steel; to the following minimum thicknesses:

B. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Fasteners: Zinc- or nickel-plated steel, slot-less type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

2.3 WARDROBE LOCKERS

A. Construction: Fully welded.

B. Components: Fabricated from steel sheet, of the following thicknesses:
   1. Frame: 16-gage.
   2. Top, bottom, and sides: 16-gage.
   3. Back: 18-gage.

4. Door: 14-gage.
5. Shelves: 16-gage.
6. Hinges: 16-gage.
7. Sloping Top: 18-gage.
8. Fillers: 20-gage.

C. Configuration:
1. Locker Units: Sizes and configurations as indicated on Drawings.
2. Base: On concrete or masonry base as indicated.
3. Locker Body: Formed and flanged; with channel-shaped intermediate horizontal frames separating two- and three-tier lockers.
4. Doors: One-piece construction with channel-shape vertical edges and angle-shape horizontal edges; 20 gage reinforcing pan welded to inside for doors over 15 inches wide and 30 inches high.
5. Hinges: Continuous type, riveted to door and frame.
6. Ventilation: Louvered vents at top and bottom of each door; provide 6 openings at top and bottom for single-tier lockers, 3 openings for two-tier lockers, and 2 openings for multi-tier lockers.
7. Door Latching: Finger-lift control in recessed stainless steel pocket; single-point latching for doors up to 20-inches high, two-point latching for doors over 20 inches high.
   a. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact and incorporating a pre-locking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock of latching mechanism.
   b. Locking: Padlock hasps for Owner-provided padlocks.

D. Accessories:
1. Furnish the following equipment inside each locker:
   a. Single-Tier Units: Fixed shelf, one double-prong ceiling hook, and two single-prong wall hooks.
   b. Double-Tier Units: Fixed shelf, one double-prong ceiling hook and two single-prong wall hooks.
2. Sloped Top: Continuous sloping top with approximately 20-degree pitch and vertical end closures.
3. ADA-compliant conversion kits for lockers identified or otherwise required by state and federal regulations. Provide with ADA plaques, adjustable shelves and clips. Conversion kit(s) installed by locker subcontractor.

2.4 FABRICATION

A. Number Plates: Furnish polished aluminum number plates on each locker door; number sequentially.

B. Form recess for operating handle and locking device.

C. Finish edges smooth without burrs.

D. Fabricate sloped metal tops, ends, and closure pieces.

E. Install interior equipment.

F. Fabricate handicap accessible units with bottom shelves nine inches above floor to meet Texas Accessibility Standards.

2.5 FACTORY FINISHING

A. Clean, degrease, and neutralize metal; finish with manufacturer's standard baked enamel finish, electrostatically-applied.

B. Color: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify prepared bases are in correct position and configuration.

C. Verify bases are properly sized.

3.2 INSTALLATION

A. Install lockers plumb and square.

B. Install lockers on concrete or masonry bases as indicated on Drawings.

C. Secure lockers with concealed anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

D. Bolt adjoining locker units together to provide rigid installation. Do not install fasteners exposed on face frames.

E. Install filler panels, end panels, and sloped tops with closures at exposed ends. Use concealed fasteners and splice plates; fit accurately together with tight, hairline joints.

F. Install recess trim with concealed fasteners and splice plates; fit accurately together with tight, hairline joints.

G. Replace components not operating smoothly.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean locker interiors and exterior surfaces.

C. 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 metal locker manufacturer.

END OF SECTION

SECTION 10 73 26 - ALUMINUM WALKWAY COVERS AND CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum walkway covers.
2. Flashing where connections to buildings are made.
3. Factory-finished metal decorative soffit systems.

B. Related Work:
1. Section 04 20 00 - Unit Masonry: Items built into masonry walls.
2. Section 07 90 00 - Joint Protection: Joint sealants.
3. Section 07 62 00 - Sheet Metal Flashing and Trim.
4. Section 09 54 23 – Linear Metal Ceiling System: Walkway faux woodgrain soffit panels to match color/finish matching of interior ceiling panels provided under 09 54 23.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Use for installation, only personnel who are skilled in the work required, familiar with the manufacturer's recommended methods of installation and the requirements of the work.

1.3 SUBMITTALS:

A. Shop Drawings: Submit Shop Drawings in accordance with Division 1 Section "Submittals".

B. Contractor shall submit shop drawings for approval by the Architect prior to fabrication of any materials. Shop Drawings shall clearly illustrate all details including but not limited to: Plan views, column layout and measurements, footing sizing and details, drainage locations and details, building wall condition details, flashing details, Canopy component sizing and thickness, Fastener sizing, large scale assembly details, and finishes by component.

1. Contractor shall verify all dimensions and elevations prior to submittal to Architect and are to be checked by Manufacturer prior to fabrication.

2. The site-specific shop drawings and calculations shall bear the seal of a Civil or Structural engineer authorized to practice in the jurisdiction where the project is located.

C. Samples for Initial Selection:

1. Manufacturer's color charts showing the full range of colors available for system members with factory-applied color finishes.

2. Physical samples of proposed exterior faux wood finish applied to aluminum panels for color match of interior ceiling slats provided under another Section. Minimum (2) 12” x 6” panels.

D. Delete above if colors are preselected and specified or scheduled. Retain below with or without above.

E. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

F. Installation Methods: Submit two copies of manufacturer's recommended installation methods.

1.4 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that

includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 PRODUCT HANDLING

A. Protection: Protect walkway covers before, during and after installation. Protect installed work of other trades.

B. Replacements: In the event of damage, make repairs or replacements as necessary:

1.6 EXTENDED WARRANTIES - Provide the following in addition to Contractor's 1-year warranty:

A. Provide manufacturer's written warranty against defects in materials and workmanship for a period of 5-years after date of Substantial Completion. Warranted defects shall include but not necessarily limited to:
1. Excessive deflection of support members or decking.
2. Failure of structural system including collapse or blow-off of any portion of system except where wind loads are in excess of those specified for design loading.
3. Corrosion of components or fastenings.
4. Water leaks at decking, components designed to carry water, or at flashings.

B. Provide manufacturer's written 2-year warranty against failure of materials receiving clear or color anodized finish. Failure of finish includes cracking, peeling, delaminating, crazing, fogging or excessive color change.

C. Provide manufacturer's written 10-year warranty against failure of materials receiving factory applied powder coat, fluoropolymer coil coating, or faux woodgrain finish. Failure of finish includes cracking, peeling, delaminating, crazing, fogging, or excessive color change.

PART 2 - PRODUCTS

2.1 GENERAL

A. Design, materials, and fabrication are based on the product of *AVAdek Walkway Cover Systems & Canopies*.

B. Manufacturers: Manufacturer shall have been in the business of fabricating custom aluminum walkway covers for a minimum of 10-years under the same company name and shall be able to provide evidence of successful completion of a substantial number of projects of similar or more complex scope than this Project. Subject to Project requirements for product substitutions, systems shall be provided by one of the following manufacturers:
1. ASA Builders, Inc., www.asabuildersinc.com.
2. AVAdek Walkway Cover Systems & Canopies www.avadek.com
3. Dittmer Architectural Aluminum; Ditt-Deck Extruded Aluminum Walkway Covers www.ditt-deck.com
4. Peachtree Protective Covers www.peachtreecovers.com

C. Design Requirements:

1. Systems shall be designed for a minimum 20 psf Live load and 25 psf Wind Uplift Load, or additional should state or local building codes require.

2. At Locations Beyond 50-Miles of the Coastline: Systems shall be designed for a minimum 20-psf Live load and 25-psf Wind Uplift Load, or additional should state or local building codes require.

3. At Locations Within 50-Miles of the Coastline: In addition to above, systems shall be designed to withstand 150-mph wind gusts.

4. It is the responsibility of the canopy manufacturer to verify and confirm the design

meets the structural load requirements as specified herein and required by applicable code authorities.

2.2 MATERIALS AND COMPONENTS

A. Beams: “U” Beams sized by manufacturer to meet all required design loads, including wind loads. Aluminum alloy shall be 6063-T61 temper. Minimum

1. Provide sizes as required by Engineer of Record, but minimum of 6” x 4” x .125” thickness.

B. Columns: Shall be extruded aluminum Alloy 6005A-T61 temper, sized by the manufacturer to meet all code-required design loading, including wind loads. Minimum section shall be 4” X 4” screw boss design. Fabricate tube columns for below-grade or surface drainage as indicated

C. Deck: Sized by manufacturer to meet all required design loads, including wind loads, (minimum 2-3/4” ht. x 6” x .078” thickness); extruded aluminum, Alloy 6063-T6 temper; roll-formed not acceptable.

1. Provide sizes as required by Engineer of Record, but minimum of 2-3/4” ht. x 6” x .078” thickness.

D. Fascia / Trim: “G” Alloy 6063-T6 temper aluminum in face height as indicated.

1. Fascia members in 12” or less face height shall be extruded material.
2. Fascia heights up to 18” shall be 0.080” minimum thickness.
3. Fascia heights greater than 18” and up to 24” shall be 0.125” minimum thickness.
4. Fascia heights greater than 24” shall be aluminum-composite material (ACM). Roll-form sheet metal is not acceptable,

E. The component sizes noted above are minimums and shall be precluded by component sizes called out on the drawings, or larger/heavier components as required to achieve the required structural performance.

F. Fasteners: Stainless Steel

G. 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.

H. Miscellaneous:
1. Provide fasteners, sealant, flashing, additional components, etc., to match bents, deck, and trim as required to provide for a complete and finished system.
2. Provide mill-finish secondary aluminum framing/furring members where required for attachment of aluminum soffit panels.

I. Aluminum Soffit Panels – Provide and install both soffit panel systems at walkway cover soffits as indicated:

1. **Type MPC-2:** Linear panels with factory-applied faux wood finish and non-perforated face.
   a. 1” deep x 6” wide x minimum 0.080” x nominal 10 ft. long extruded aluminum alloy 6063-T6 panels with faux wood powder coat finish. Roll-form not acceptable.
   b. Interlocking joints for butt joint appearance.
   c. Stagger end joints of adjacent panels minimum 12”.
   d. Provide with matching perimeter trim, and secondary aluminum or galvanized framing as required for support and wind uplift.
   e. Base color to match interior linear ceiling panels (MPC-1) provided under another Section.

2. **Type MPC-3:** Flat=faced aluminum composite panels with factory-applied anodized finish

and non-perforated face.

a. Nominal 3-ft. wide x 10-ft. long x 0.157” thick sandwich panel 8000 System as manufactured by NOW Specialties or approved equivalent by Alcan Composites, or Arconic Architectural Products.
   1) Aluminum Facers: ASTM B209, 0.0197 inches thick pre-coated aluminum sheet with strippable protective film.
   2) Core: Manufacturer’s standard thermoplastic material.
   3) Fasteners: Concealed stainless steel screws.
   4) Joint Splines: 4-mm thick x 3 1/4-inch width, matching material, finish and color of panels.

2.3 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

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 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.

C. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

1. Decking, Perimeter Fascia, and Exposed Framing: AA-M12C22A41 Anodic coating, Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1. Satin finish.

2. Concealed Secondary Framing/Furring: Any concealed framing above decorative soffit panels (not including anodized decking); Contractor’s option for mill finish or specified clear anodized.

3. Decorative Soffit Panels:

   a. **Type MPC-2:** Factory polyester powder coat finish meeting AAMA 2604 in faux wood-grain design. Base color as approved by the Architect. Product as manufactured by Quality Powder Coating, www.qualitypowdercoating.com.
      1) Finish electrostatically applied to 2-4 mil thickness and polymerized along with ink printing film for faux wood grain by baking at 400-degrees F for 20-minutes.
      2) Color and “wood grain” pattern approved by the Architect for coordination with interior linear metal ceiling panels provided under another section.

   b. **Type MPC-3:** AA-M12C22A41 Anodic coating, Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1. Satin finish.

PART 3 - EXECUTION

2.1 INSTALLATION AND ERECTION

A. Coordinate installation with scheduled concrete, masonry and roofing work.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Erection shall be by manufacturer in accordance with approved Shop Drawings.

END OF SECTION

SECTION 10 75 00 – FLAGS AND FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ground-set aluminum flagpoles.
   2. Flags.

B. Related Sections include the following:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete footings for flagpoles.
   2. Section 07 90 00 - Joint Protection: Elastomeric sealant filling the top of the foundation tube.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpole assemblies, including anchorages and supports, capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."
   1. Base flagpole design on polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.
   2. Basic Wind Speed: As indicated on Drawings; 3-second gust speed at 33 feet above ground.

1.3 SUBMITTALS

A. Product Data: For each type of flagpole required.

B. Structural Calculations: For flagpoles indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Include below-grade foundation requirements.
   2. Include all specified and required accessories, including halyard lockbox.

C. Qualification Data: For professional engineer.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.
   1. Obtain flagpoles through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Flagpole www.hapcopoles.com
   2. The Baartol Company Inc. www.baartol.com
   3. Concord Industries, Inc. www.flagpoles.com
   4. Lingo Inc.; Acme Flagpole Division www.lingoinc.com
   5. Pole-Tech Company Inc. www.poletech.com

2.2 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

B. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.

C. For tapered flagpoles, provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Exposed Height: 35-feet.

E. Aluminum Flagpoles: Provide entasis-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/ (B 241M), Alloy 6063, with a minimum wall thickness of 3/16 inch. Heat treat after fabrication to comply with ASTM B 597, Temper T6.

F. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.064-inch minimum 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 all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
1. Provide flashing collar of same material and finish as flagpole.

2.3 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, non-fouling, revolving truck assembly of cast metal with continuous 5/16-inch diameter, braided steel halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
1. Provide one halyard and one cleat at each flagpole.
2. Provide cast-metal cleat covers, finished to match flagpole, secured with cylinder locks.
3. Provide halyard covers consisting of a 2-inch channel, 60 inches long, finished to match flagpole.

C. Halyard Flag Snaps: Provide two stainless-steel swivel snap hooks per halyard.
1. Provide with neoprene or vinyl covers.

D. Lockbox: Provide welded lockbox to protect movement of halyard. Provide miniumum 3 keys to Owner.

2.4 MISCELLANEOUS MATERIALS

A. Concrete: Comply with requirements in Division 3 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.

B. Sand: ASTM C 33, fine aggregate.

C. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (non-traffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

2.5 FLAGS

A. Flags: Commercial-quality nylon, 4 x 6 foot size; furnish one flag of each of the following types:
1. United States.
2. State of Texas.

2.6 FINISHES

A. Metal Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Aluminum: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.

D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use non-staining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.2 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to manufacturer’s written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2 inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION

SECTION 11 40 00 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK

A. Project Name and Location: Elementary School No. 23
Alvin ISD

B. Approval of Working Surface: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. The beginning of work by any contractor shall constitute acceptance of the previous work.

C. Field Verification of All Dimensions: Before ordering any materials or doing any work, field verify all measurements of the building and be responsible for their accuracy. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect or Foodservice Design Professionals (FDP) for instructions before proceeding.

D. Cutting and Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true, and of the proper size in their work, as may be necessary for the proper installation of their and other contractors' work. After such work has been installed, the contractor shall carefully fit around, close, repair, patch, and point up the same as directed to the satisfaction of the Architect.

E. Cooperation: The General Contractor, all other contractors, and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity to install their work and store their material.

F. Inspection and Tests: The architect, Owner, Foodservice Design Professionals (FDP), and their representative shall always have access to the work, whether in preparation or progress. Provide proper and safe facilities for such access and inspection.

G. Fees, Permits, and Inspections: Secure and pay fees for all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, codes, rules, regulations, and contract requirements bearing on the work.

1.3 SCOPE OF WORK

A. Include the Work specified, shown, or inferable as part of Food Service Equipment. Portions of this Work may be subcontracted to those qualified to do such work as necessary because of jurisdictional trade agreements and restrictions.

B. The General Contractor is responsible for Related Work specified in other Sections: i.e., final plumbing, electrical and mechanical connections. The Kitchen Equipment Contractor (KEC) is responsible for all internal connections.

C. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and equipment adjustment in this contract. Plans and specifications shall be considered mutually explanatory. Work required by one, but not by the other, shall be performed as though required by both. Items required by one but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings so that all equipment items shall be entirely functional for the purpose for which they were designed and intended. Provide all necessary material, tools, equipment, and labor required for the complete delivery, un-crating, erection, and installation as designated on the food service equipment plan and, in the specifications, to be made ready for final connection by the appropriate Division contractors. When there is any discrepancy between drawings and specifications, bidders should seek clarification of any discrepancies from the Architect and or Foodservice Design Professionals (FDP) before bidding.

D. Should the drawings disagree in themselves or the specifications with the drawings *(and clarification was not sought before bidding)*, the higher cost, better quality, more stringent, and greater quantity of the work or materials shall be completed without additional costs to the Owner.

1.4 OTHER DIVISIONS/CONTRACTORS RELATED WORK

A. Division 03 (Concrete) is responsible for but not limited to:

1. Slab depressions reinforced concrete wearing bed at prefabricated walk-in assemblies.

2. Concrete or masonry platforms (with a finished top and coved base at the perimeter) for the raised setting of food service equipment.

3. Slab depressions to receive stainless steel drain trench liner/grate assemblies (provided under this Section).

B. Division 09 (Finishes) responsible for but not limited to:

1. Interior finished floor with a coved base at prefabricated walk-in assemblies.

C. Division 10 (Specialties) responsible for but not limited to:

1. S/S Corner Guards throughout the kitchen (unless specified otherwise).

2. Lockers.

D. Division 22 (Plumbing) is responsible for but not limited to:

1. All connections shall be made in accordance with local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty PVC and wide-sweep bends for refrigerant piping to beverage lines, Co2 lines, and remote food service equipment refrigeration systems.

3. Rough-in and final connection of plumbing systems to food service equipment and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 22. This includes but is not limited to the installation of all faucets (water fill faucets, pre-rinse faucets, etc.), hoses, gas disconnects and drains from the equipment point of connection to building plumbing systems. All drain lines are provided and installed by Div. 22.

a. Kitchen Equipment Contractor is responsible for providing all faucets (water fill faucets, pre-rinse faucets, etc.), drain fittings, mixing valves, control valves, water pressure regulators, vacuum breakers, and all accessories for equipment specified under 11 40 00. Division 22 is responsible for installation.

4. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type 'K' Copper.

5. If any plumbing accessories or fittings are provided loose with equipment by 11 40 00, Div. 22 is to attach to equipment and provide final connection.

6. Gas Supply Systems with all components and fittings required for a complete system.

7. Water Supply Systems with all components and fittings required for a complete system.

8. Compressed Air Systems with all components and fittings required for a complete system (if required for this project).

9. Piping and Drainage Systems (Sanitary and Grease-laden). ***Systems must be cleaned and flushed before the final connection with food service equipment - Critical.***

10. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.

11. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.

12. Trench Drains (Provide and Install). Trench Liners provided by 11 40 00. Flange and liners to be flush with the finished floor.

13. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe through Grease Trap and/or Interceptor.

14. P-Traps as required (including all disposers).

15. Interconnect water through Water Filter (Filter provided by 11 40 00 unless otherwise specified) to equipment.

16. Gas Quick Disconnect Installation (Quick Disconnect provided by 11 40 00).

17. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 11 40 00).

18. Specified couplings and piping to all equipment furnished by 11 40 00.

19. Air Compressors (if required for this project) (Size, Provide, and Install unless otherwise specified).

20. Water Softeners (if required for this project) (Size, Provide, and Install unless otherwise specified).

21. Pressure Boilers (if required for this project) (Size, Provide, and Install unless otherwise specified).

22. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required. Water temperature to be at least 100 degrees and flow for at least 20 seconds.

23. Ice Bin Drain Insulation (if Ice Machine is provided in this project) (Provide and Install).

24. Unions at disposer solenoid valves (if Disposer is provided in this project) (Provide and Install).

25. Back Flow Prevention as required (Provide and Install - including all disposers). Back-Siphonage shall be installed at all fixtures and equipment where backflow and/or back-siphonage may occur and where a minimum air gap cannot be provided between the water to the fixture or equipment at its flood/level rim. When furnished with equipment, vacuum breakers shall override the above if acceptable with applicable codes. Division 22 is responsible for verifying requirements with local codes.

26. Janitor Sink with Faucet (Provide and Install).

27. Freeze Proof Hydrant at the exterior of the building by receiving door (Provide and Install - unless otherwise specified).

28. Reverse Osmosis Systems (Size, Provide (unless otherwise specified), Locate, and Install).

29. All piping within the counter body or under fabricated counters must be run to a connection point below the counter body by Section 11 40 00—final connection by Division 22.

30. Exhaust Hood condensate drain connections (if Exhaust Hood is provided in this project) (Provide and Install).

31. Interconnection of ½" CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker (if Disposer is provided in this project).

32. Fire System Piping. The exposed piping is to be chrome plated.

33. Pipe ½" cold water to swirl inlets at disposers (if Disposer is provided in this project).

34. Water Treatment for Ice Builders (Non-Chlorinated water with a PH Level of 10 or Higher) and any drains and overflows. Piping from Ice Builders to Tumble Chillers by Div. 23 (if Ice Builders and Tumble Chillers are provided in this project).

35. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

E. Division 23 (Mechanical) responsible for but not limited to:

1. All connections shall be made following local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Rough-in and final connection of mechanical systems to food service equipment, walk-in assemblies, and between components (including materials and labor).

4. A mechanical contractor will test and balance rooms and exhaust hoods.

   Balance report for food service Exhaust Hoods to be provided to Foodservice Design Professionals (FDP) immediately upon completion

   (send to Houston.Submittal@fdp.org) and must be submitted with O&M manuals.

5. Exhaust Hoods, Condensate Hoods, Fire Suppression Systems, connections, and controls (Provide and Install – unless otherwise specified). Provide tempered air at all supply ducts.

    a. If Exhaust/Condensate Hoods and Fire Suppression Systems are specified under Section 11 40 00, Division 23 is responsible for all Exhaust and Condensate Hood connections (Provide and Install).

6. VFD System and controllers when required by code (Provide and Install).

7. Provide and install all ventilation (direct or indirect), air conditioning, and heating systems (unless otherwise specified).

8. Coordinate Supply and Return ducts above Serving Counters. No cold air is to blow directly on hot food counters or open-air refrigerated merchandisers.

9. Coordinate Supply and Return ducts away from equipment with top-mounted refrigeration. No cold air is to blow directly on compressors.

10. Mechanical Contractor to locate temperature monitors within return ducts.

11. Circulating air above walk-in assemblies (Provide and Install).

12. Circulating air above and in air gaps at warehouse cold storage assemblies (Provide and Install).

13. Water Chillers as required (if equipment is provided in this project) (Provide, Size, and Locate).

14. Piping from Ice Builders to Tumble Chillers (if equipment is provided in this project) (Size, Provide and Install).

15. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

F. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, walk-in assemblies, and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 26.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Empty EMT Conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPUs, etc. Division 26 to verify where the conduit will run for POS System (i.e., Manager’s Office or IDF Room).

4. Empty EMT Conduit with pull-wire and wide-sweep bends for fire suppression systems. Interconnect the Fire Protection System to panel box shunt trips and building alarm.

5. Walk-in Assembly Light Fixture Installation (Provided loose by Section 11 40 00) (if Walk-in is provided in this project).

6. Table Limit Switch (Provided loose by Section 11 40 00) (if Dishmachine is provided in this project) – Install and interconnect to Dishmachine.

7. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).

8. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).

9. Charging Stations for Forklifts, Pallet Stackers, and Pallet Jacks (Size, Provide, Locate, and Install) (if equipment is provided in this project).

10. Interconnection between Condensate Fan and Dishmachine control panel (if equipment is provided in this project).

11. Interconnection between Exhaust Hood fans and switch (if equipment is provided in this project).

12. Interconnection between Exhaust Hood lights and switch (if equipment is provided in this project).

13. Door Heaters, Lights, Coils, and Heated Pressure Relief Ports pre-wired to the junction box at the top of walk-in assemblies (if equipment is provided in this project) provided by Section 11 40 00—final connection by Div. 26.

14. If any electrical accessories, fittings, and cord/plugs are provided loose with equipment by 11 40 00, Div. 26 is to attach to equipment and provide final connection.

15. Provide waterproof receptacles in wet areas.

16. All electrical connections beneath Exhaust Hoods (if equipment is provided in this project) to extend to shunt trip breakers with electrical panel box for shutdown during fire mode.

17. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.

18. All electrical lighting, power, and distribution systems.

19. Do not interconnect more than three (3) convenience outlets on one (1) breaker.

20. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.

21. Doorbell at receiving door (Provide and Install –audible throughout Kitchen, Office, and Dry Storage room).

22. Adequate lighting at receiving door.

23. (if Walk-in is provided in this project) Walk-in Manufacturer is to provide Two (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. Walk-in manufacturer will install One (1) located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an ‘inline’ assembly), and provide the second unit loose for installation by Division 26 located in the Cafetorium (Division 26 to coordinate location with Owners and Architect). Division 26 is to provide all conduit and wiring required and interconnect the illuminated Push Button

Panic Alarm in the Walk-In Freezer to both Strobe Beacons (***Critical***). Coordinate with Division 27.

24. Dedicated circuit for heated drain line connection in Walk-In Freezer (120/1/16.0 Amp) at each coil (if Walk-In is provided in this project).

25. GFCI Breaker for all receptacles under Exhaust Hoods (if Hoods are provided in this project) and Holding Cabinets (if Holding Cabinets are provided in this project), to be located within Kitchen's electrical Breaker Panel and not at the receptacles.

26. Remote GFCI reset switches to be accessible to end user.

27. All electrical below Exhaust Hoods (if Hoods are provided in the project) are to have Shunt Trip Breakers.

28. Interconnect Temp Sensor to Exhaust / Supply fans (if Hoods are provided in this project).

29. Electrical contractor to provide conduit with pulled wires prior to installation of equipment.

30. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.

G. Division 27 (Communication) responsible for but not limited to:

1. Data line coordination for food service equipment.

2. Time clocks as required.

3. Video cameras for learning assistance in food service areas as required (Provide, Locate, and Install).

4. (if Walk-in is provided in this project) (Provide conduit, data line, and interconnect the illuminated Push Button Panic Alarm inside the Walk-In Freezer to the Building Automation System (BAS). When activated, facility personnel are to be notified - coordinate notification requirements with the Owner (***Critical***). Coordinate with Division 26.

H. Division 28 (Electronic Safety and Security) is responsible for but not limited to:

1. Security Cameras as required (Provide, Locate, and Install).

I. General Contractor responsible for but not limited to:

1. Any wall penetration required for food service equipment utilities. Escutcheon plates or S/S sleeves are to be provided and installed as needed.

2. Bulk Freezer Ventilation Pipe (if Bulk Freezer is provided in this project) (Provide and Install unless otherwise specified).

3. Core drilling for Guide Rails (if Guide Rails are provided in this project).

4. Refrigeration Roof Curbs / Roof Jack (if Refrigeration System is provided in this project and located on the roof).

5. Interior Bollards (if required for this project) – to be epoxy painted per local codes (Provide and Install).

6. Furnish and Install ¾" Plywood blocking in the wall for mounting equipment furnished by Section 11 40 00 as required.

7. Walk-in Depressions (to be dead level) and sand leveling bed (if Walk-in is provided in this project and recess is shown).

8. Structural bracing for Bulk Walk-in Assembly ceiling panels if required.

9. Menu System Video Monitors in Servery (unless otherwise specified).

10. Structural bracing for Menu System Video Monitors if required.

11. Interior/Exterior refrigeration penetrations and sleeves at building penetrations.

12. DoorScope viewer (peephole) with wide viewing angle at receiving door.

13. Canopy at receiving door. Coordinate height with the height of Receiving Door (8') and the mounting height of Air Screen above the door.

14. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.

15. Washer and Dryer (Provide and Install, unless otherwise specified).

16. Dwarf wall at exposed front/ends of cafeteria serving counters with the finish as selected by the Architect (if required in this project).

17. Substrate (Provide and Install) at SS Wall Caps for pony walls.

18. Final cleaning of all equipment before demonstrations.

1.5 QUALITY ASSURANCE

A. In addition to complying with all applicable laws, statutes, building codes, and regulations of public authorities, comply with the following:

1. National Sanitation Foundation (all equipment to bear label)

2. National Electric Code

3. Underwriters' Laboratories, Inc. (all applicable equipment to bear label)

4. American Gas Association Laboratories

5. National Fire Protection Association

6. Americans with Disabilities Act

7. Food and Drug Administration HAACP Guidelines

8. International Energy Conservation Code (IECC)

9. Department of Energy

10. Environmental Protection Agency

11. CSA Group

B. Furnish certification of regularly manufactured equipment listing or classification by Underwriters Laboratories, Inc., with the initial submittal.

C. Furnish a list of equipment and components (internal and external) that are not of domestic origin. All equipment and components (internal and external) should be of domestic origin when possible. This information should be provided with the initial submittal.

D. Projects outside the continental United States shall adhere to all local authorities having jurisdiction over that project.

1.6 SUBSTITUTIONS

A. **The specified equipment items or components are intended to be the basis of the bid. All other brands, including any additional names, which may be listed as "Alternates" or "Approved Equal," must conform with the general and item specifications, warranties, size/dimensions, quality, accessories, function, voltage, horsepower, etc. of the first-named brand and be subject to Paragraph C-03 of this Article.**

B. Proposed Substitutions:

1. Submitted at least 14 calendar days before Bid Date.

2. Submit proposed substitutions with catalog data and manufacturer's shop details indicating all modifications required to conform with the specified brand.

3. List of deviations must include equipment name, model number, accessories, and features with deviation(s) noted for specified and proposed alternate equipment. Equipment without listed deviation(s) will be considered furnished as specified.

C. Substitutions with prior approval:

1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.

2. Owner reserves the right to accept or reject any or all substitution proposals before execution of the Contract.

3. Provide all design/engineering services required to adjust in space, systems, utilities, etc., and pay all additional costs of utilities, construction, or professional services that may be incurred due to the acceptance of any substitution.

D. All appliances or other equipment within a common group or category (e.g., refrigerators, kettles, ovens, shelving, etc.) must be from the same manufacturer.

1.7 INTERPRETATION OF DOCUMENTS

A. During Bidding: Bidder's, supplier's, or vendor's questions and comments about Construction Document's clarity or intent will be addressed by addendum.

B. After Award:

1. Clarification Bulletin will confirm Construction Document requirements.

2. Request for Information submitted by Contractor shall contain Contractor's proposed resolution.

1.8 WARRANTY

A. Provide a written warranty for parts and labor for one year ***from the date of Substantial Completion***, including an extended four-year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement before one year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.

C. Refrigeration Systems/Equipment: One-year free service available within twenty-four hours of notification.

D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number, and name of the person to contact. The service agencies selected shall be factory-authorized for the equipment assigned whenever possible.

E. Provide the following for refrigeration systems/equipment unless specified otherwise:

1. One (1) year of free refrigeration system service is available within twenty-four hours of notification.

2. Provide five (5) year manufacturer's registered written replacement warranty certificate covering compressor bodies. Warranty to cover labor costs for the first year.

3. Provide ten (10) years of the manufacturer's registered written replacement/repair warranty certificate covering walk-in assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.

4. Provide two (2) year parts and labor warranty for ***all parts/components (including third-party components that may be utilized)*** of the refrigeration system(s) ***(including freon)***, walk-in cooler(s), and freezer(s) not otherwise covered herein.

F. ***All above-stated warranty periods are from the date of Substantial Completion***. All replacement parts due to a warranty call should be the same quality as the original, or better if the original were defective. Replacement parts should be of domestic origin where possible.

1.9 SUBMITTAL DATA

A. **All submittals must be received, reviewed, and approved as noted prior to equipment procurement. If any equipment is procured prior to this process, it is on the KEC to replace any equipment, accessories, or other components that may not meet the specifications or design intent for the facility, including all costs associated with rectifying the errors made in procuring the equipment before this critical process.**

B. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.

C. Submittal Requirements:

1. Kitchen Equipment Contractor to furnish all submittals via PDF, drawings to be scaled per General Specifications and provided in Three (3) submittal packages.

2. Foodservice Design Professionals requires the below-listed business days for each package submitted. Packages are to be submitted within 14 days between each issued package. Each package should contain individual submittal sets.

    a. Package One to include (2) Individual sets: 10 Business Days for Review

        i. Equipment rough-in

        ii. Equipment Brochure

    b. Package Two to include (3) Individual sets: 10 Business Days for Review

        i. Exhaust Hoods

        ii. Walk-in Cold Storage Assemblies

        iii. Refrigeration

    c. Package Three to include (4) Individual sets: 15 Business Days for Review

        i. Custom Fabrication

        ii. Serving Counters

        iii. Merchandising Equipment

        iv. Miscellaneous Submittals

D. Submittals to be identified with the below-listed file name structure:

1. 11 40 00-1 EQUIPMENT BROCHURE

2. 11 40 00-2 EQUIPMENT ROUGH-IN PLANS

3. 11 40 00-3 CUSTOM FABRICATION

4. 11 40 00-4 SERVING COUNTER

5. 11 40 00-5 EXHAUST HOODS

6. 11 40 00-6 WALK-IN COLD STORAGE ASSEMBLY

7. 11 40 00-7 REFRIGERATION

8. 11 40 00-8 BEVERAGE MERCHANDISER

E. Package One (1) requires both submittals: Brochure and Rough-in plans. **If not sent together, the submittal will be rejected.**

F. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.

G. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.

H. If discrepancies, missing information, or incorrect information occur within the documents, Kitchen Equipment Contractor is to seek clarification or note the need for further direction on

submittals. The Kitchen Equipment Contractor is to bid the higher of the discrepancies. *Refer to Section 1.3 SCOPE OF WORK: Subsection D.*

I. Brochure Format (for regularly manufactured equipment and components):

1. Front and rear protective cover with labeled project name.

2. Brochure index: Indicate Functional Area/Room number, item number, quantity, description, and manufacturer.

3. A separate flysheet for each component or item of equipment, indicating item number, name, quantity, manufacturer, optional equipment, modifications, special instructions, and utility requirements. Any equipment or assembly containing more than one buyout sub-assembly or component shall have the second item listed in parenthesis beside the primary item name—for example, Serving Counter (hot food well).

4. Catalog specification sheet with all options notated on the specification sheet and manufacturer's drawing.

J. Shop Drawings (Rough-In Drawings):

1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced). Submittal drawings are to be provided by Kitchen Equipment Contractor and not copied or reproduced from Contract Documents. Any reproduced submittal drawings will be rejected.

2. ¼" scale drawing of fixed/movable food service equipment and prefabricated Walk-in assemblies with itemized schedules.

3. Special Conditions Drawings, sizing, and locating the following conditions:

a. Slab depressions, cores, sleeves, or block-outs (walk-in assemblies, drain trenches, piping, etc.).

b. Concrete or masonry platforms.

c. Pipe sleeves or roof jacks.

d. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.

e. Blocking grounds or anchor plates required in walls for equipment support/attachment.

f. Above-ceiling hanger assemblies for support of exhaust hoods, ceiling-mounted pot racks, etc.

g. Access panels in walls or ceiling for service of equipment.

h. Ceiling pockets or recesses for unusually high equipment.

i. In-wall carriers for wall-hung or cantilevered equipment.

4. Electrical Rough-In Drawing

5. Plumbing and Mechanical Rough-In Drawing

6. Required information:

   a. All fixed and portable food service equipment shown on Contract Drawings.

   b. All prefabricated Walk-In Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.

   c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices, not in this Section.

   d. All Rough-In Drawings: Fully dimensioned from engineering benchmark (column lines, when provided) and finished-room surface to the point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical, and plumbing services.

   e. Connection number/tag system and symbols: Identical to Contract Drawings.

K. Shop Drawings (Manufacturer's and Fabricator's):

1. Sheet Size: Identical to Contract Drawings, drawn or plotted at a ¼" scale for plan view, ½" for elevations, and 1½" for sections and construction details.

2. Included information: The item number, name, and quantity.

3. Construction details, sections, and elevations to reflect the requirements of the Specifications and Drawings.

4. Indicate adjacent walls, columns, and equipment.

5. Indicate plumbing and electrical schematic drawings for equipment such as conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems, and fabricated fixtures with a single electrical or plumbing connection.

6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment, or replacement of all moving parts.

L. All equipment and engineering rough-in plans sheet numbers are to match the contract documents. All equipment item numbers and engineer item numbers located on the schedules are to match the contract documents. All engineering requirements must be updated to accommodate the provided equipment and match the contract documents. The Kitchen Contractor coordinates any MEP revisions to accommodate the supplied and proposed equipment. The Kitchen Equipment Contractor is responsible for any costs associated with equipment substitution.

M. Foodservice Design Professionals (FDP) drawings and schedules are not to be copied in any way. Any replicated drawings of Foodservice Design Professionals (FDP) will be rejected.

1.10 SERVICE MANUAL

A. Three copies bound in 1½" hardback, three-ring binders (as many volumes as required by the scope of the project) with the same data as the brochure after installation (Refer to "Submittal Data"). Provide separate service manuals for each independent area within the project scope (Main Kitchen, Culinary, Concession, etc.).

B. Each Volume: Section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).

C. Catalog specification sheet and/or manufacturer's shop drawings, including wiring diagrams when applicable.

D. Each Volume: Index of items, manufacturer's operating/maintenance information, replacement parts data, list of all product warranties, and price lists. Provide the name, title, and address of personnel at each respective manufacturer and service personnel to be contacted for spare/replacement parts and service after the warranty period.

E. To the greatest extent possible, provide two copies of the manufacturer's instructional video cassettes for operating, maintenance, and equipment service.

F. Internally subdivide binder contents with permanent page dividers, logically organized by equipment item number or manufacturer name, with tab titling printed under reinforced, laminated plastic tabs.

G. Electronically submitted manuals must follow the formatting requirements listed above.

H. **Service Manual to be provided to the owner before kitchen equipment demonstration.**

1.11 VERIFICATION AND COORDINATION OF PROJECT / DATA

A. Utilities Rough-in Drawings and field verifications are to be completed within four weeks after receipt of notice-to-proceed. Review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors.

1. KEC to provide on-site field verification of all underground utilities before pouring concrete for capacity and location and coordinate with General Contractor. Submit a review to Architect and General Contractor. If rough-ins need to be relocated, KEC will compensate other trades for the required relocation.

2. KEC to provide on-site field verification of all other utility connections and locations and coordinate with General Contractor. Submit a review to Architect and General Contractor.

B. On-Site Inspection Reports

1. Before concrete pour: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

2. Before delivery of equipment: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Concrete Pour

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of UNDERGROUND utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

FOODSERVICE DESIGN PROFESSIONALS

CSA INSTALLATION APPROVAL REPORT

Report Date_____ **Project Name** _____

KEC Firm_____ **Phone Number**_____

Contact Name_____ **Email** _____

- ☐ **Walk-In panels are installed square, plumb, and level. Inspected prior to interior concrete pour.**
- ☐ **Ceiling panels are installed flush and tight to wall panels with undamaged gasket material. Any signs of condensation at joints or walls should be reported to FDP and addressed immediately. Caulk at panel seams will not be an acceptable solution.**
- ☐ **All cam-locks are engaged, and buttonholes are in place.**
- ☐ **Gaps under the screed or floor angle (due to shimming) are entirely sealed to the slab.**
- ☐ **Penetrations in the ceiling or wall panels are insulated and sealed.**
- ☐ **Weatherproofing / thermal barrier material is installed.**
- ☐ **All sharp edges of metal doors and diamond treadplate are clean of sharp edges and deburred.**
- ☐ **Door bumper or wall protection is installed and located as to prevent damage of door to adjacent walls.**
- ☐ **Cove base installed at all wall bases internal and external of walk-in.**
- ☐ **Door systems are correctly installed, and the door is self-closing and seals around the opening perimeter and at the floor threshold. Threshold has a smooth and level transition.**
- ☐ **Upon completion of the electrical connections, confirm the final operation of the IC/IC+ control, door heaters and light switches.**
- ☐ **Entrapment hardware and alarm systems are installed and functioning.**

KEC SIGNATURE_____

COMMENTS_____

_____

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Delivery of Equipment

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of INSTALLED utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

C. Review critical systems/components for application, performance, and capacity and submit calculation worksheets with the initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:

1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes, and locations.

2. Refrigeration Systems (compressor, condenser, and evaporator) capacities/sizes, quantities, and refrigerant piping distances/sizes.

3. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler, fuel interlocks, piping/distance limitations).

4. Locations of Vacuum Breakers.

5. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.

6. Gas and water line sizes and manifold configurations.

7. Diameter and length of flexible connector lines for fixed/movable gas appliances.

8. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).

9. ADA compliance of workstations, service positions, passageways, etc.

D. Ceiling mounted appliances/fixtures: Verify and coordinate dimensions/location of support framing/hangers with the General Contractor—all material and installation below 12’-0” AFF: Section 11 40 00.

E. Dimension Responsibility: Obtain actual or guaranteed measurements for the proper equipment fit. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment and notify the Architect of all conflicts or deviations from the dimensions shown.

F. Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for their correctness. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.

G. Scheduling to Fit Openings: Should it become necessary to schedule the construction of walls or partitions before delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.

H. Refrigerated and Dry Storage Areas: Verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of the variance between the Contract Documents and actual conditions.

I. Color/Pattern Selections: Submit selection samples of solid polymer products, plastic laminate, paint or stain finishes, and vinyl-coated surface material of equipment as selected by the Owner.

J. Movable Equipment Interface: Rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at the time initial of shop drawing submittal. Indicate conflicts and proposed adjustments.

K. Relocation of Work: Relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.

L. **Kitchen Equipment Contractor must provide FDP with the food service equipment lump sum pricing (including material and labor) after the contract has been executed and *before submittals* are provided to FDP. *This information is critical to FDP for accounting/billing purposes.***

1.12 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

A. Obtain and coordinate utility requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and rough-in drawings/provisions.

B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.13 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with the Owner at least ninety (90) days before equipment requirement.

B. Obtain and coordinate utility requirements of OF/CI equipment with the building utilities and rough-in drawings/provisions.

C. Receive at the job site and fully incorporate into installation procedures as if furnished under this Section.

PART 2 - PRODUCTS

2.1 FABRICATED FIXTURES MATERIAL / COMPONENTS

A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.

1. Stainless steel joints and seams: Heli-arc welded, free of pits and flaws, ground smooth, and polished to a No. 4 finish.

2. The “grain” direction of horizontal stainless-steel surfaces: Longitudinal, including the backsplash. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

B. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.

1. Galvanized iron joints and seams: Arc-welded, free of pits, flaws, and ground smooth.

2. Galvanized sheets or shapes: Washed with mineral spirits and painted with Rust-Oleum gray semi-gloss enamel.

C. Sound Deadening: Schnee Butyl Sealant ½" wide rope positioned continuously between all frame members or contact material and underside of stainless-steel surface (sinks, tabletops, food wells, over shelves, and undershelves). Tighten stud bolts for maximum compression of sealant and trim excess.

D. Plastic Laminates: Color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be NSF-approved (Standard No. 35).

E. Solid Polymer products: Color/pattern/material selected by Architect in thickness as specified. Solid Polymers and adhesives must be N.S.F. approved (Standard No. 51).

F. Casters:

1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Verti-Lock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.

G. Cutting Boards: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated.

H. Identification Plates, Labels, Tags:

1. Prohibited Information: Names of suppliers, fabricators, and contractors.

2. NSF Labels: Required on all pieces of equipment.

3. Required Information: Function or purpose of controls such as display light switches, food warmer controls, etc.

4. Plate Construction: Engraved phenolic plastic, secured to equipment with epoxy cement or stainless-steel screws. Furnish samples.

2.2 PLUMBING / MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components: Furnished under this Section as follows:

Note: Fitting and components described in Items 1, 2, 3, 4, and 5 are furnished loose by 11 40 00 for final installation and connection by Division 22.

1. Control valves and appliance pressure regulators for water, gas, steam, and vacuum breakers: wherever required on food service equipment (chrome-plated where exposed).

2. Faucets and drains with and without connected overflows (unless otherwise indicated) for all sinks.

3. Specialty food service water-fill faucets, hose bibbs, or hose assemblies indicated in drawings/specifications.

4. Wade Model No. W-10 Shock-Stop shock absorbers for all food service equipment with quick-opening or solenoid-operated water valves.

5. Dormont Series Water Quick Disconnect hose, diameter per water connection size requirements, with safety fitting, w/coiled restraining device, full port ball valve, antimicrobial coating, lifetime warranty.

6. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food-holding components of serving counters (e.g., cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: All drains to be type 'K' Copper – Paint with aluminum paint where exposed**. Div. 22 to ensure a minimum air gap of 1" and not less than twice the effective opening of the indirect waste pipe, per code. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.**

7. Piping brackets and supports beneath fabricated equipment.

8. Closed Base Bodies: Removable 18-gauge stainless steel closure panel at plumbing penetrations under the top.

9. Control valves on Open Base fixtures: Mounted on a 14-gauge stainless steel gusset-shaped panel with h 3½" setback from the countertop edge/rim to the face of the control handle.

10. Fill hose/faucet at support pedestals or Closed Base Body: Installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger-bracket for the hose.

11. Provide filtration option as shown on contract documents (a, b, c, or combination thereof):

    a. In-line Water Filter System:

        i. Everpure System filters for coffee/tea brewers, icemakers, water chillers, convection steamers, and beverage systems. They should be sized per the manufacturer's recommendation.

    b. Remote Central Water Filter System.

    c. Remote and/or In-line Reverse Osmosis system.

B. Gas-Heated Equipment Fittings and Components: Furnished under this Section as follows:

1. Fixed Equipment: Dormont 1675KIT2S48 gas appliance connector: Diameter per fuel volume/connection size requirements. Gas valve diameter size per fuel volume/connection size requirements.

    a. Restraining device: Heavy duty steel cable, fastened to equipment and walls, 3" to 6" shorter than equipment connector length.

C. Final Plumbing Connections Provisions:

1. Fabricated equipment containing components, fittings, and devices indicated on food service connection drawings to be connected to the building systems: each component, fitting, or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.

2. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, convection ovens, etc.): plumbing components completely

interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

3. All plumbing final connection points of equipment shall be tagged, indicating the following:

   a. Item number

   b. Name of devices or components

   c. Type of utility (water, gas, steam, drain, chilled water)

D. Ducts and Vents:

1. Exhaust hoods furred-in to ceiling: 2" high duct collar for final connection to the duct system.

2. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18-gauge stainless steel seamless duct risers to 6" above the finished ceiling for final connection. The duct: trimmed at the ceiling with a 16-gauge stainless steel angle flange with all corners welded.

E. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Sub Sections E. Plumbing and F. Mechanical for additional information.

2.3 FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS

A. Install complete with all refrigerants, oil, dials, dehydrators, gauges, and controls required for the system's proper operation.

B. Self-contained or factory-installed compressors: Check and adjust to the proper operating temperature prescribed by FDA/HACCP.

2.4 PLUMBING TRIM

A. Faucets: Furnished for all sinks or equipment requiring open water supply.

B. Fill Faucets: Furnished for appliances requiring open water supply.

C. Drain Fittings: Furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. The solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS

A. All electrical systems, components, and accessories within the work of this Section: Certified to be in accordance with NEC 70.

B. Electrical Fittings and Components: Furnished under this Section as follows. Coordinate food service equipment loads, voltage, and phase with the building system and confirm any existing or OF/OI equipment requirements.

C. Cord and Caps:

1. Coordinate all food service equipment cord/caps with related receptacles.

2. All 120, 120/208, and 208 volts “plug-in” equipment shall have Type SO or SJO cord and plug with ground wire fastened to the frame/body of the item.

3. Cord lengths for fixed equipment: Adjusted to eliminate loose-hanging excess.

4. All non-fixed plug-in “buy-out” equipment: Hubbell configuration and ratings as required.

5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8’-0” cord length with cord-hanger strap secured to the rear of equipment or mobile stand.

D. Switches and Controls:

1. Each motor-driven appliance or electrically heated unit: Equipped with a control switch or starter per Underwriters’ Laboratories, Inc., with low-voltage and overload protection.

2. Disposer controls recess-mounted in the wall: External fittings and accessories removed from the enclosure and furnished with 12-gauge stainless steel perimeter angle flange with welded corners. Install control at 4’-0” AFF to the bottom of the enclosure.

3. Disposer controls recess-mounted in counter-splash risers: External fittings and accessories removed from NEMA 4 enclosure and furnished with 12-gauge stainless steel perimeter angle flange with welded corners. Install control at 3’-0” AFF to the bottom of the enclosure. Provide the panel with a 60” long Seal-Tite electrical conduit from the bottom of the control panel for final field connections under Division 26.

4. Equipment that is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.

5. All remote manual starters, disconnect switches, magnetic contactors or starters, and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.

E. Heating Elements:

1. Electrically heated equipment: Thermostatic controls.

2. Water heating equipment: Equipped with positive low water shut-off.

F. Receptacles and Switches:

1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12” x 8½” x 3” deep recessed mounting panel sloped at a 60° angle and turned up to the top of the opening.

2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6” from the bottom of utility or compressor compartments.

3. Receptacles mounted on Open Base fixtures: Installed on a 12” x 10½” x 4½” deep 14-gauge stainless steel panel with returned ends and sloping recess—secure panel to the underframe of fixture top.

4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on the underside of the lower shelf. Vertical runs of wiring: Made in rigid conduit or within the tubular leg.

5. Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.

6. Switches installed in/on-fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and a junction box installed within 6” from the bottom of the utility or compressor compartment. All refrigeration system switches: Installed within the compressor compartment near the door opening.

7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to the load center with balanced phase loading. Load center: Ready for final connection by Division 26 and flush-mounted within the utility compartment rear panel, set back 8” from the access door. All breaker/device information will be typewritten on the circuit schedule in the load center door (number corresponding breaker/device) with an enclosed schematic wiring diagram of fixture components.

8. All receptacles are to be pre-wired to the cord and plug assembly and routed through the over-shelf post at all island equipment locations unless specified otherwise.

G. Light Fixtures:

1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).

2. LED Display Light: Install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.

3. Heat Lamps: Installed to the underside of serving shelf assemblies. When multiple 24” heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remotely from lamps.

4. **Walk-in assembly LED Light Fixtures: Furnished by Section 11 40 00, final installation by Div. 26. All electrical wiring and conduit, provided by Div. 26, electrically connected through the Vapor Proof light fixture base connection, located on the interior door header—all Conduit to be Seal-tight conduit. Door frame wiring stubs out the top of panels 8” in flexible conduit for final connection by the electrical contractor. All horizontal conduits: below ceiling panels. All lighting fixtures will be wired from inside the assembly—no penetrations through the ceiling panels. Seal-sleeved penetrations are airtight at both sides of the panel. KEC is responsible for verifying that trade contractors seal all penetrations.**

H. Final Electrical Connection Provisions:

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: Direct connected, with each component, fitting, or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.

2. Fabricated equipment containing electrically operated components and devices indicated: Circuit-breaker load center with each component or device pre-wired to a

separate circuit breaker for balanced phase loading and single final connection by Division 26.

3. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawings by Division 26.

4. Pre-wire the following groups of walk-in assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).

   a. Light fixtures and switches; heated pressure-relief ports.

   b. Door/jamb heaters.

   c. Evaporator fans, defrost elements and drain line heaters.

5. All electrical final connection points of equipment shall be tagged, indicating the following:

   a. Item number.

   b. Name of devices on the circuit.

   c. Total electrical load.

   d. Voltage and phase.

I. Lamps: in all food service equipment containing light fixtures. Refrigerator or heated cabinets: All exposed LED lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.

J. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection F. Division 26 (Electrical) for additional information.

2.6 CUSTOM – FABRICATED / ASSEMBLED UNITS

A. Mechanical or electrical operating components or products integrated into a fabricated fixture: Ventilation and service access required or recommended by the manufacturer. The size and placement of the service access panel(s) permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 BAKER TABLETOPS (Unless specified otherwise)

A. 14-gauge 304 S/S top with 2” square turn down at the front, 6” high enclosed splash at two (2) sides and rear. Brace same as “Counter/Tabletops.”

B. 1¼” x 6” high integral coved riser at rear and ends unless indicated otherwise on drawings.

C. 16-gauge stainless steel flour-trough at free long sides, secured to the underside of the top. Trough: 3” diameter with eased edges/corners.

2.8 COUNTER / TABLETOPS

A. 14-gauge stainless steel; all free edges turned down 2” with ¾” tight hem at the bottom—free corners: rounded on ¾” radius.

B. Marine edges: Turned up ½” on 45º angle and turned down 2” with ¾” tight hem at the bottom.

C. Cafeteria serving countertops at hot food stations: Full-length x 3½” x ½” high raised rail at (customer’s) front side with 45º integral turndown to counter surface.

D. Tops abutting high fixtures or walls: Cove up specified height and slope back 1½” at the top on 45º angle; 2½” slope where piping occurs. Turn down 1” at the rear of the splash and tight ends to the bottom of the top turndown. Secure splash turndown to the wall with a 4” long 14-gauge stainless steel “Z” clip anchored to the wall, 36” OC.

E. Freestanding tables and all serving counter splash-risers: Turned back at a 90º angle with 1” turndown at the rear.

F. Brace tops with rigid-welded 1½” x 1½” x 1/8” galvanized steel angle frame at the perimeter with cross bracing 2’-0” OC maximum. Provide 4” x 4” x 12-gauge stainless steel triangular pads where leg gusset welds to frame. Paint the entire frame with Rust-Oleum gray semi-gloss enamel. Angle frames: Secured to the underside of top surfaces with ¼” studs welded 9” OC maximum with chrome-plated washer, lock washer, and cap nut. Studs: Such length that cap nuts can be made up tight, bringing the top down snugly on the angle frame, eliminating all vibrations or “oil-canning.”

G. Tops: 1½” overhang at free sides of underframe or Closed Base Body.

H. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly or integrally welded stainless-steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground, and polished to match the top. When conditions permit, provide a 1” x 1½” rectangular backsplash opening for service utilities instead of piercing the horizontal surface. Install stainless steel split tubing at the raw edge of the opening.

I. Extend underbracing members to the wall, turn down 6”, and anchor to the wall when specified to be mounted on leg/bracket assembly.

J. All openings in tops: 3/16” high raised die-formed edges.

K. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½” deep, secured to the underside of the countertop.

L. All “built-in” and “drop-in” counter equipment/appliances to have framing members at the perimeter of the opening.

M. Scrap Basket: 18-gauge stainless steel construction 6½” x 6½” x 21¾” long. Top of container: 5/8” wide x ¼” high full perimeter flange with ¼” diameter stainless steel rod bail handle. Interior vertical corners coved on ½” radius. Countertop: Fitted with 6¾” square die-stamped opening.

2.9 COLD PANS

A. 14-gauge stainless steel with ¾” coved interior welded integrally to the countertop with a 3/16” raised edge at the perimeter of the opening – depth of cold pan to follow NSF 7 compliance.

B. Slope bottom to required quantity of Component Hardware Model No. E16-4021 drain fittings at 48” OC maximum. Sleeve through insulation at drain fittings and extend common drain line into utility compartment for indirect waste connection.

C. ½” OD copper refrigerant lines in a serpentine pattern, 1½” OC flattened for maximum contact. Secure tubing to the underside of ¼” thick aluminum “distribution plate” installed tight to the underside of the frost plate area and apply cold-conductive mastic to all surfaces.

D. Component Hardware Model No. E16-4021 drain fittings at 48” OC maximum, sleeved through the insulation with common drain line extended into utility compartment.

E. Heat Cable: Low-wattage, full-perimeter, below countertop at the edge of depression. Secure with “Z” clips, 9” OC, and interwire with compressor switch for simultaneous operation.

F. Enclose the sides and bottom of pans with an airtight 18-gauge galvanized jacket and pack with 2” fiberglass insulation set in mastic.

G. Compressor: Size as indicated or required to accommodate the size of the cold pan. Locate the compressor in the compartment below the unit or as shown on the drawings.

H. Sectional 16-gauge stainless steel perforated false bottom (¼” holes, @ ¾” OC). Turn down 1½” on all sides, weld corners, and provide finger rings. False bottom sections: 24” long maximum.

2.10 DRAWERS

A. Stainless Steel Liners: Component Hardware Model No. S81-2020C (20” x 20”), easily removable with drawer in the fully extended position.

B. Drawer Frame: 16-gauge stainless steel flanged out at the top. Weld the frame to a double-panel 16-gauge stainless steel drawer front with full-length recessed pull at the top (similar profile as Garcy Model No. R-1060) with closed ends.

C. Channel-formed horizontal pull: ¾” turndown at the front and ends with ½” tight hem. The front edge of the pull: flush with the face of the drawer. Recess behind pull: sloped up on a 60° angle, terminating 1” below the bottom edge of pull.

D. Mount drawer frame on Component Hardware Model No. S52-2020 self-closing slides, with Delrin bearings, full-depth of the fixture. Secure slides to the body or brackets to eliminate lateral movement in the extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides with Delrin bearings.

E. Drawer enclosure in an Open Base Fixture: 18-gauge stainless steel flanged out at the top for attachment to the underside of the tabletop. The lower edge of the enclosure is flanged in toward the open bottom. Mount drawer slides to enclosure and brace as required. The face of the enclosure is to be the same length and height of the drawer face. Provide ¾” deep offset in front of the enclosure and 2½” from the underside of the tabletop for a flush-fitting appearance.

F. Drawer enclosure on freestanding fixture: Full depth of table framing.

G. Drawer enclosure in a Closed Base Fixture: Completely partitioned from the adjoining area. Drawer front: Flush fitting with the face of the body.

H. Drawer Liners other than tool/utility: **Bread Drawer:** S/S liner sized to fit drawer; **Refrigerated Drawer:** S/S liner sized to fit drawer.

I. Cash Drawer: Integral stainless-steel body, 3” deep.

2.11 FOOD WELLS (UNLESS SPECIFIED OTHERWISE)

A. Food Warmer Controls: Remote-mounted in sloping recessed apron panel. The control panel is recessed 2½” from the bodyline at the top of the 60° slope and 1” at the lower edge. Terminate slope angle 2½” below the countertop. Mount panel on concealed piano hinge at bottom edge; secure with screws at upper corners.

B. Manifold all warmer drains and extend to within the utility compartment for indirect waste connection. Install valve in the drain line and extend handle through compartment door.

C. Removable 18-gauge stainless steel closure panel at the underside of warmers.

D. 14-gauge stainless steel plate/utensil shelf full-length of hot food station unless noted otherwise: 10” below countertop x 9” deep, with rear panel coved up to the underside of the countertop; end panels turned up square. Front of shelf: Turned down 1½” and returned under for closure panel attachment.

E. Food wells: Hatco Model No. HWBIBRT-FULD insulated food warmer (1200 watts, 208 volts, single phase) secured to the underside of 12” x 20” die-stamped countertop openings with thermal breaker mastic rope applied at the perimeter of food well flange.

F. Soup Warmers: Hatco Model No. HWB-11QTD soup warmer secured to the underside of 11” diameter die stamped countertop opening with thermal breaker mastic rope applied at the perimeter of soup well flange. The maximum allowable temperature of the countertop at the contact surface is: 120°F. Each warmer: Equipped with one 11-quart stainless steel round insert and slotted cover.

2.12 SINKS

A. 14-gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾” radius. 1½” wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 14-gauge stainless steel filler panel welded ground and polished between compartments.

C. Sinks (with overflow): Score and slope sink bottom ½” to die-stamped opening fitted with Fisher 22306 twist waste valve 3 1/2” x 2” with overflow and tailpiece. 18-gauge stainless steel bracket: Welded to sink bottom for drain stem with 1½” handle clearance.

D. Where sinks are installed in fixtures with Closed Base Body, provide a Fisher 22306 twist waste valve 3 1/2” x 2” with overflow and tailpiece. (Sinks with dimensions larger than 20” x 20” in Closed Base Body will not have overflow fitting.) 18-gauge stainless steel bracket: welded to sink bottom with T & S Model No. BL-4740-1 guide bushing. Install on shortened drain stem, one T & S Model No. BL-4710-1 remote control stem assembly only (length as required) with Model No. 113-L universal joint and white blank button. Set drain control handle in Cambro Model PSB-6 bowl with bottom omitted (dress raw edge) to permit passage of drain handle—secure bowl in utility compartment door or body panel with clear silicone.

E. When single-hole deck-mounted faucets are specified, install overflow fitting in the sidewall of the sink compartment and provide ell-fitting in connecting tubing.

F. Flush Covers when specified: 1/2” thick Read Products, Inc. “Richlite” cutting board with two (2) finger holes, size as indicated. Support clips: ¼” stainless steel rod 2” long, formed at 45º

with two ¾" leg ends (¼" long threaded ends). Insert rod clips through tight-clearance holes in the sink, seal watertight, and secure with stainless steel acorn nuts or tack-weld at the exterior of the sink wall. Set support clips ½" below the top. Provide a 14-gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: Adjacent to sink compartment, below countertop, or under drawer assembly.

2.13 TRAY SLIDES (UNLESS OTHERWISE SPECIFIED)

A. Tray slides: 12" wide, solid 14-gauge stainless steel turned up 2" at the rear behind countertop turndown; turned down 4" at the front and free ends unless otherwise indicated.

B. Three ¼" high die-formed inverted "V" ridges at 4" OC, 2" from the leading edge, terminating 2" from ends of tray slide with tapered ridge ends.

C. Ridges formed on radius: Equal-length segments with 2" separation between chords.

D. Secure tray slides to countertop/body frame, same as "Countertops." Enclose the exposed underside of the tray slide with 18-gauge stainless steel.

E. When indicated, project tray slides 2" beyond the serving countertop and return the entire width of the serving counter at free ends.

F. All tray slides are to be provided and mounted per ADA requirements.

2.14 DISHTABLES

A. Soiled/clean dishtable: 14-gauge stainless steel; free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.

B. Edge of dishtables next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and secure to wall with 4" long 14-gauge stainless steel "Z" clips anchored to the wall, @ 36" OC.

C. Exposed rear splash: 16-gauge stainless steel finish panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end. Secure the panel with concealed attachment and install bracing 24" OC.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot to sinks, scuppers, or ware wash machines, maintaining level crown/splash.

E. Brace dishtables with 1" x 4" 12-gauge stainless steel channels down the top centerline and between each pair of legs, with closed ends. Bracing: secured to the underside of the dishtable with ¼" studs welded 6" OC maximum, with chrome-plated washer, lock washer, and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops; ground and polished to match the top.

G. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

H. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.

I. Paper-Drop Opening: 9” square with 4” integral chute having hemmed bottom edge. Slope dishtable top 1” toward the opening, forming a 16” square tapered deposit point.

J. Accessible Tray-Drop Opening: 10” x 18” with integral 16-gauge stainless steel seamless chute sloped at 45º angle toward the center of mobile soak sink position.

K. All dishtables with a Conveyor Type Dishmachine must have a table limit switch provided by Manufacturer and installed by Division 26. Prepare clean dishtable with holes for table limit switch and provide s/s back cover. Wiring must be concealed within dishtable fabrication.

2.15 DISH / TRAY DEPOSIT ASSEMBLY

A. 14-gauge stainless steel deposit shelf, size as indicated. Extend the frame through the opening, flush with the public side of the partition, height as local code authorities require. Turn the shelf down 1” at the front with ¾” return at the bottom (either scribed into a partition or forming reveal). Shelf: 1” square turndown at the long rear side, integral with conveyor slider pan, tray-accumulator, or dishtable. Extend the rear/end splash to align with the head of the deposit station opening. Modify rolled rim at the operator’s side of the tray drop window to have a 3” rolled rim.

B. 18-gauge stainless steel window frame with perimeter flange channel-formed 1” x ¾” at both wall sides. Weld all corners of the frame and install with concealed attachment. Align/abut one jamb of the frame with end splash of conveyor slider pan or dishtable whenever adjacent.

2.16 UTENSIL – WASH COUNTERS

A. 14-gauge stainless steel; all free edges coved up 3” with 1½” diameter rolled rim and bullnose corners.

B. Edges of utensil-wash counters next to high fixtures or walls: Coved up 10” and sloped back 1½” on 45º angle; 2½” slope where piping occurs. Turn down 1” at the rear of splash and secure backsplash to the wall with 4” long 14-gauge stainless steel “Z” clip anchored to wall @ 36” OC. Vacuum breaker pockets: 4” long square turnback sections aligned with the slope break line.

C. Exposed Rear Splash: 16-gauge stainless steel finished panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end of the splash and ½” turnback at the bottom of the panel. Secure the panel with concealed attachment and install bracing 24” OC.

D. Cove all interior corners (horizontal/vertical) on ¾” radius and slope tables 1/8” per foot, maintaining level crown.

E. Brace utensil-wash counters with 1” x 4” 12-gauge stainless steel channels down the centerline of the top and between each pair of legs, with closed ends. Bracing: Secured to underside of dishtable with ¼” studs welded 6” OC. maximum, with a chrome-plated washer, lock washer, and cap nut. Studs: Such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and “oil-canning.”

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match the top.

G. Extend underbracing members to the wall, turn down 6”, and anchor to the wall when specified to be mounted on a leg/bracket assembly.

H. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

2.17 DOORS

A. 18-gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal the perimeter joint of the pans. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the Body.

B. Channel-formed full-length horizontal recessed pull: ¾" turndown at the front and ends with ½" tight hem. The front edge of the pull: Flush with the face of the door. Recess behind pull: Sloped up on a 60° angle and terminated 1" below the bottom edge of pull.

C. Door Hardware

1. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).

2. Component Hardware Model No. 35-2000 Concealed Magnetic Catch.

3. Component Hardware Model No. D30-4780 lock in the upper free corner of the door.

D. Louvered opening: Cut out opening size as indicated, turn in 1", and weld. All corners: Ground and polished.

1. Full-height 18-gauge stainless steel louver with 1" vanes at 45º, ½" spacing. Perimeter channel-formed frame: 1½" x 1".

2. 45º x 1" x ½" x opening width plus ½" 18-gauge stainless steel louver.

3. Tack the louver flange's weld tab to the door's back panel.

E. Drain handles opening: 6" diameter hole through the double pan to accommodate Cambro Model No. PSB-6 Bowl:

1. Secure the bowl to the door panel with clear silicone.

2. Omit the bottom of the bowl. Dress raw edges of opening for passage of drain handle.

3. Exposed insulation at the penetration of the door pan: Painted black.

F. Sliding Doors: fabricate same as Paragraph "A."

1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required. Secure to angle frame at the top of the underside.

2. Front/rear door sheaves: Stainless steel ¾" side-mounted door hangers; two (2) required per door.

3. Recessed Vertical Pull at Upper Corner of Door: Component Hardware Model No. P63-1012.

4. By-Passing Door Guides secured to bottom shelf: Component Hardware Model No. B62-1093.

5. Door Stop at the bottom edge of door: Component Hardware Model No. B60-1086.

G. Offset the lower horizontal framing member of the Closed Base Body/utility compressor compartment to align the door flush with the bottom of the Body.

2.18 CLOSED BASE BODIES

A. Frame: Rigid-welded 1½" x 1½" x 1/8" galvanized steel angle forming a continuous structure around the top and bottom perimeters of the fixture, a post at each corner, studs spaced 48" OC maximum. The top of the frame is cross-braced with 1½" angles, 2'-0" OC maximum.

B. 18-gauge stainless steel panels and trim with concealed attachment. All seams: Welded, ground, and polished.

C. Exposed Vertical Corners: Rounded on ¾" radius. Closed Base Bodies adjacent to walls or fixtures: square corners.

D. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: Closed and sealed.

E. Closed Base Bodies set on finished masonry platforms: closed and caulked at the underside of equipment overhang and bolted to the platform. Body overhang of the platform: 1" at free ends and 2" at the front and exposed rear sides.

F. Closed Base Bodies not set on the platform: Component Hardware Model No. A54-2-6, 6" legs spaced 4'-0" OC maximum.

2.19 COMPRESSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.

B. 10-gauge steel slide-out support: Channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on the solid platform: front-to-back slide-out support channels set 4" above the bottom for air circulation.

C. Access Door: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full length of the top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turndown at front and face of the door. Recess behind pull slopes up on a 60° angle, terminating 1" below the bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

D. Access Doors Louver: Full-height, with 1½" x 1" x 18-gauge stainless steel channel-formed frame with welded corners. 18-gauge stainless steel louver. Submit a sample of the design for approval.

2.20 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: Fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full-length of the top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turn down at the front of the door, a recess behind the pull slopes up on a 60° angle, terminating 1" below the bottom edge of the pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of the door with the face and bottom edge of the body. Door hardware: two (2) Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.

D. No shelves of Closed Base Fixtures are to be penetrated.

2.21 UTENSIL RACKS

A. Rack: ¼" x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match the shape shown on drawings. Lowest band - 7'-6" AFF unless otherwise indicated.

B. Ceiling Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing from band to 18" above the ceiling. Anti-sway bracing above the ceiling - 1½" Unistrut members. Tubing penetrations at the ceiling - Component Hardware Model No. A16-0206 stainless steel gussets.

C. Table Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing extended through countertop. Secure to closed base framing or cross rail/undershelf on the open base fixture. Tubing penetrations of countertops - integrally welded stainless steel inverted gusset.

D. Utensil Rack Hooks - Component Hardware Model No. J77-4401 stainless steel hooks spaced 8" OC maximum.

E. Electrical Receptacle: NEMA No. 5-20-R or as noted. Mount in fully welded 3½" x 5½" x 3" 14-gauge stainless steel enclosure with ½" radius corners. Stainless steel cover plate to fit specified receptacle. Pre-wire through tubular support for final connection above the ceiling by Division 26.

2.22 CASHIER / SERVING COUNTERS

A. Exterior Body Panels, when specified: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.

B. Position, size, and finish horizontal or vertical reveal as Architect directs.

C. Secure panels to counter body framing in a concealed manner. Install removable panels with "Z" clips overlapping body framing members.

D. Hinged doors in exterior body panel(s) - Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three (3) required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with the submittal.

E. Cashier counter to have 16-gauge s/s intermediate shelf, turned down 1 1/2" with tight hem at front. Cove up 2" at rear and sides. Brace undershelf with 1" x 4" 14-gauge stainless steel channel at the longitudinal centerline. Provide an outlet for power/data within the body above the intermediate shelf. Provide cash drawer inserts per district standards.

F. Sneeze Guards to be adjustable and meet NSF standards.

2.23 OPEN BASE STRUCTURES

A. 1-5/8" OD x 16-gauge seamless stainless-steel tubing legs bevelled at the bottom. 1¼" OD cross rails fully welded (360° smooth and polished) to legs at 10" AFF, OC.

B. Top of Leg: Inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.

C. Bullet Foot: Component Hardware Model No. A10-0851.

D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to the floor with non-corrosive bolts.

E. Table Bases: Maximum leg spacing of 6'-0" OC; dishtable and utensil wash counter bases at 5'-0" OC.

F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): Tubular legs at the front side only with Component Hardware Model No. A10-0854 flanged feet anchored to the floor with non-corrosive bolts. Front-to-back cross rail: fitted into Component Hardware Model No. A20-0406 circular gusset secured to the wall with non-corrosive bolts.

2.24 UNDER SHELVES

A. Open Base Structures: 16-gauge stainless steel turned down 1½" with tight hem at the bottom. Notch all corners to fit tubular legs and weld from the underside to fill the gap, grind, and polish. Cove up 2" at the rear or ends adjacent to wall, columns, refrigerators, etc. The turn-up at freestanding fixtures is to be hemmed tight to the bottom of the turndown. Brace undershelf with 1" x 4" 14-gauge stainless steel channel at the longitudinal centerline and each intermediate pair of legs.

B. Open Base Structure specified to be supported by brackets at the rear side only (not completely cantilevered): 16-gauge stainless steel turned down 1 ½" at free sides with tight hem at the bottom edge. Notch all corners to fit tubular legs as required and weld from the underside to fill the gap, grind, and polish. Cove up 2" at rear ends, as indicated. Fill the gap at the front-to-back rail, grind, and polish. Brace undershelf with 1" x 4" x 1" 14-gauge stainless steel channel at longitudinal centerline between front to back rails.

C. Closed Base Fixtures: 16-gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: Turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.

1. Shelves: Turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.

2. All shelf partitions at exposed ends of cabinet bodies or interiors: Free of exposed framing members.

3. Reinforce shelves with full-length 1" x 4" x 14-gauge stainless steel closed hat channel.

4. Unless otherwise noted, all closed base undershelves must be 22" deep and clear.

5. Fully weld smooth and polish the vertical seam of the shelf turndown/turn up with the face of the body partition.

6. Seal the vertical seam of the square turn-in at the exposed interior of open shelf sections.

2.25 ANCHOR PLATES / WOOD GROUNDS

A. Behind the finished surface, wherever building walls, partitions, or ceiling construction will not accommodate direct attachment of equipment such as over shelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 11 40 00.

B. Anchor Plates: Not less than 12” x 12” x ¼” thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: Length required by fixture, component, or device, 24” wide x ¾” thick plywood secured to partition system before gypsum board installation.

D. Above ceiling supports: Structural shapes (4” x 8.0 lb. channel) suspended from the structure. Maximum height 15’-0” AFF. Size: width of equipment x length of equipment plus 6’-0”. Cross bracing at 6’-0” OC maximum.

2.26 OVER SHELVES

A. 16-gauge stainless steel with free edges turned down 1” with ½” tight hem at the bottom—¾” radius at free corners.

B. Turn up 2” raw at walls and sides with a horizontal coved corner at the rear. Round front corners of turn up on ¾” radius.

C. Where shelf width exceeds 12” width, reinforce with ½” x 4” x 14-gauge stainless steel closed hat channel full-length of the shelf.

D. Wall-Mounted Shelves: 16-gauge stainless steel brackets 48” OC maximum, set in 6” from ends.

E. Freestanding Shelves: Where splash is required at free over shelves, turn up square 2” at ends, cove up at the rear, and hem tight to lower edge of front turndown. Weld exposed corners.

1. Freestanding over shelves: 16-gauge stainless steel cantilevered brackets at the rear of the table; double-cantilevered brackets at the center of the table. Posts for cantilevered over shelves are 1-5/8” OD x 16-gauge stainless steel secured to the underframe, 4’-0” OC. Ends of shelves: Secured to adjacent wall/fixture or mounted on 1¼” diameter stainless steel posts.

2. Freestanding over shelves not on cantilevered brackets: 1¼” OD x 16-gauge stainless steel posts, each pair at 4’-0” OC maximum.

F. Baker Table Over shelves: Supported 18” above the top with 1¼” OD stainless steel tubular supports with channel shoe secured to risers.

G. Glass/Cup Rack Over shelf at Dishtables: 14-gauge stainless steel with 1½” deep “vee” trough at free long sides with 1” tight hem inside the trough. Provide a ½” marine edge at free ends and; a 4” splash at the wall. Suspend shelf at 18” above dishtable surface on

posts/brackets anchored to dishtable frame/wall at rear; 1” OD stainless steel tubing supports from the structure above the ceiling at front edge, 60” OC at each end.

1. Install at both ends a ½” stainless steel drain tube (connecting both vee-troughs) extended to the dishtable surface through splash turnback.

2. Rack-rest: horizontal full-length 1-5/8” OD stainless steel tubing supported at 10” OC above shelf (8” OC for double service shelf) by 1¼” OD stainless steel tubing with closed ends. Support tubing: welded, ground, and polished, spaced 60” OC.

3. Rack-rest supports to wall: 4” x 4” x 10-gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.27 DRAIN TRENCH LINER / GRATING

A. Liners: 14-gauge stainless steel in sizes as indicated.

B. Interior of liners: 6” deep with all interior corners (horizontal/vertical) coved on ¾” radius; sloped and scored 1” to integrally welded Component Hardware Model No. D34-Y011 basket drain assemblies @ 48” OC, fitted with 6” long welded tailpiece. Stainless steel safety chain: connected to basket strainer assembly and top of liner wall.

C. Liners: 1” wide perimeter shoulder at the top, turned up flush with finished floor, tight hemmed back down to the shoulder level, and flanged out 2” for attachment to the slab.

D. Underside of sloping liner portion: 2” long “Z” clips.

E. Grating: IMC-TEDDY PFD-ADA removable fiberglass grating:

1. 1” deep “I” bearing bars with 0.6” wide top flange.

2. Full perimeter frame, section quantities, and sizes indicated.

3. Maximum of 2’-0” sections.

4. Grating bars should be spaced 0.4” apart per ADA requirements.

5. Grating to be two (2) equal sizes.

2.28 WALL PANELS

A. Wall Panels: 18-gauge stainless steel, double pan-formed ½” thick with internal stiffener members. Fill with USDA-approved thermal insulation, full height, and width of panels, and attach to the interior with mastic. The maximum allowable temperature at the rear side of the panel: is 120°F.

1. Height of panels as required: Top of tile base to the underside of the hood, top of tile base to the top cap of stub wall, or top of splash to the underside of the hood.

2. Level and square lower edge and sides.

3. Butt joints on all panels.

2.29 EXHAUST HOODS (SURFACE-MOUNTED CONDENSATE)

A. Hoods: Size/shape as indicated: 18” high on the interior.

B. Body: 16-gauge stainless steel, with all seams welded, ground, and polished.

C. Continuous condensate trough at perimeter: 3” x 1”.

D. Frame the top of the hood with 1½” angle iron assembly and suspend from the structure above the ceiling by ½” diameter steel rods, drawn tight against the finished ceiling surface.

E. Duct opening/collar as specified with stainless steel louvered grille over the opening.

F. Div. 22 to extend drain line to floor sink when shown. The drain line is to be silver painted. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.

G. ½” diameter steel hanger rods at 4’-0” OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.

H. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.

2.30 EXHAUST HOODS (UNLESS SPECIFIED OTHERWISE)

A. Exhaust to be provided to meet all current local jurisdiction mechanical and energy code requirements. Kitchen Equipment Contractor to verify code requirements and coordinate with Divisions 23 and 26. Hoods over production equipment to be Type 1 with continuous capture. All Type 1 hoods should be 6’ deep to ensure smoke/steam capture unless otherwise noted.

B. Install fire suppression system(s) in all ventilators specified in this section. Install per the manufacturer’s recommendations and applicable codes or standards. Submit installation certification form to Architect.

C. Locate chemical cylinders as indicated on drawings and install piping to exhaust hood(s) in a concealed manner. Set cylinders and cabinets at 7’-0” clear AFF unless noted otherwise. Provide polished chrome plated tubing piping/fittings, where exposed at cylinder location and at the interior of exhaust ventilator—exposed pipe threads in/above the food zone are not allowed. Submit a schematic installation diagram and confirm critical distances from cylinders to nozzles.

D. Remote manual release located in the path of egress from the protected exhaust hood area. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements before submittal review. All conduits will be recessed within the wall; SURFACE MOUNTING WILL NOT BE ACCEPTED.

E. Provide one (1) handheld Type ‘K’ and ABC 6-liter fire extinguisher per Ansul system, surface wall mounted.

F. Required quantity and sizes of mechanically operated gas valves.

G. Confirm interconnection of all equipment as required to ensure exhaust hood and fire suppression systems are entirely operational and meet local jurisdiction code requirements.

H. ½” diameter steel hanger rods at 4’-0” OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.

I. Provide an appropriate quantity of fire suppression systems as required by local jurisdiction code requirements.

J. Double wall insulated construction at ends. S/S where exposed.

K. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.

L. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection E. Division 23 (Mechanical) for additional information.

2.31 HIGHLIGHTING

A. Polish the following vertical surfaces to a No. 8 finish:

1. Serving and display shelf turndowns.

2. Conveyor and dish/tray deposit station turndowns/frame.

3. Tray slide turndowns.

2.32 SHOP / FIELD JOINTS

A. Field joints: The least number is used only when equipment size must be limited for building or interior space access.

B. Stainless steel tops (including edges and splashes): Fully welded, ground, and polished to match adjacent surfaces.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1” above the horizontal coved corner. The remaining height of the field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw joints: located and noted on shop drawings.

D. Hairline butt joint: 1½” x 1½” x 1/8” steel angles welded to the back/underside of countertop/shelf. Offset angle beyond joining metal edge ½” (min.) to provide a flat backing surface for a joint with the angle of other joining metal edge, set for ½” space between vertical legs of angles. Bolt sections together with 5/16” machine bolts, lock washers, acorn head cap nuts, set 3” OC.

E. Closed Base Bodies: Draw-type with hairline seam fully field-welded.

F. Millwork: Plastic laminated joints shall be dowelled, glued, and draw-bolted with fasteners.

G. Solid Polymer: Surfaces drawn tight, filled, sanded, and finished to match adjacent surfaces.

2.33 PREFABRICATED WALK-IN COLD STORAGE ASSEMBLIES

A. Assembly to be installed by Factory Authorized Installers only.

B. KEC to provide a 1-year walk-in assembly panel installation warranty. Panel installation warranty to cover labor and part replacement issues resulting from a failure to complete the following during installation:

1. Walk-in assembly panels to be installed square, plumb, and level.

2. To create a proper seal, ceiling panels must be installed flush and tight to wall panels with undamaged gasket material. Any signs of condensation at joints or assembly wall panels should be reported to FDP and addressed immediately. Caulk at panel seams will not be an acceptable solution.

3. All cam-locks should be engaged and cam-lock covers in place.

4. Any gaps under the floor angle (due to shimming) must be entirely sealed to the slab.

5. All penetrations in the ceiling or wall panels should be insulated and sealed by appropriate trade contractors and verified by KEC, including but not limited to Light Fixtures, Refrigeration Lines, Sprinklers, Temperature Sensors, etc.

6. Proper installation of the door systems should allow the door to self-close and seal around the perimeter of the door opening and at the floor threshold.

7. Final operation of the IC/IC+ control, door heaters, and light switches should be confirmed upon completion of the electrical connections.

8. The walk-in assembly panel installation warranty will cover service issues resulting from faulty installation.

C. **KEC is responsible for overall install accuracy/quality and quality control of work performed, regardless of the installer or any field modifications due to building/construction conditions. KEC is to provide the CSA Installation Approval Report (provided in this document) to Foodservice Design Professionals (FDP) upon completed installation, verifying that all items above have been inspected by the KEC for completeness and installed per manufacturer requirements. This report will be required as part of the completion of the contract.**

D. Sectional Assemblies: Size/shape indicated on drawings; 9'-6" interior clearance unless otherwise specified. Door locations/size: exactly as shown.

E. Sandwich Panel Insulation: Class 1 Urethane with a vapor barrier, 4" thickness (unless specified otherwise) with mature "U" factor of .030 or lower. Finished panels shall be UL-listed and demonstrate a flame spread rating of 20 or less. Panels must meet performance standards as outlined in U.S. Government legislation.

F. Wherever compartment dimension exceeds the clear-span ability of ceiling panels, provide I-beam support on the exterior of the ceiling or spline-hangers. Install ½" diameter steel rods through beams/hangers and secure them to the structure above. Beams or posts within compartments are not acceptable.

G. Reinforce prefabricated wall panels to rigidly support the door assemblies. The perimeter of the door and frame shall be built of a fiberglass reinforced polymer (FRP) pultrusion. All pultrusion's shall be non-conductive, non-corrosive, rust proof and NSF listed. All doors shall be furnished with a replaceable aluminum braided heater wire, electronically monitored, and controlled as to initiation temperature, termination temperature and percentage of operation time as required. Install 2" x 4" 16-gauge stainless steel hat-channel full-width of the jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

H. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side – interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob. Emergency Strobe Beacons are by Division 26.

I. Provide an aluminum cove base at the interior and exterior of exposed panels for all floor assemblies.

J. Floor Installations:

1. **4" Recessed Exposed Factory Floor Installation (if required):**

   a. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

   b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

   c. 4" commercial grade manufacturer's dura floor with diamond treadplate surface and marine grade plywood subfloor.

   d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.

   e. 1/2" sand leveling bed by G.C.

2. **8-1/2" Recessed Floor Installation (if required):**

   a. Factory floor in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

   b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

   c. 4" manufacturer's floor.

   d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.

   e. 1/2" sand leveling bed by G.C.

   f. Concrete flooring and tile over insulation by Divisions 03/09.

3. **12" Recessed Floor Installation (if required):**

   a. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

   b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

   c. 4" manufacturer's floor.

   d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.

   e. 1/2" sand leveling bed by G.C.

   f. Concrete flooring over insulation by Division 03:

      i. Concrete mix: 5000 psi @ Freezers and 3000 psi @ Coolers.

      ii. No limestone or fly ash; fiberglass reinforced.

iii. #3 rebar, set on 12” centers in both directions.

iv. Center rebar vertically in wearing bed.

v. 10” high concrete 45° angled wall curb at interior perimeter per food service details.

g. Diamond treadplate wall panels on the interior and exposed exterior by 11 40 00. Refer to drawings for height. Coordinate diamond treadplate wall covering at the interior with angled wall curb.

h. Ventilation Pipe Requirements by G.C.:

i. Bottom perforated vent pipes to be #40 PVC on six ft. max centers open on both ends with the thermostatically controlled fan on (1) end and perforated mesh on the opposite end of the fan at the exterior of the building.

ii. Vent pipes are to be turned parallel with the exterior wall - 180°turn down.

iii. Vent pipe openings to be held at 24” above grade or roof per design.

iv. Fans to be Grainger Manufacturer and sized per airflow needs. Airflow is to be sized based on the length and number of bends.

v. If no exterior wall is adjacent, vent pipes will route up and extend past the roof. Roof penetrations by Division 07.

4. **Surface Mounted Factory Floor Installation (if required):**

a. 4” commercial grade manufacturer’s dura floor with diamond treadplate surface and marine grade plywood subfloor.

b. 36” reinforced diamond treadplate internal ramp.

c. 10-gauge stainless steel threshold to provide a smooth transition to the interior walk-in assembly floor.

K. Modularm Model No. 75LC (Unless otherwise specified). Integrated, flush-mounted temperature monitor/alarm with sensor and probe-cord length required to extend from the exterior front of the assembly to a mounting position of the sensor within the evaporator return airstream. System to have an easy-to-read LCD with high and low alarm set points with audible and visual alerts for alarm conditions. System to include Adaptive Programming for automatic set point control. Wi-Fi connectivity is included for remote notifications of alarms such as power failure, high and low temperatures, entrapment, and door open. System to include a built-in panic alarm. The system is to be interconnected to the Building Automation System (BAS) or the Owner’s Network (by Division 27) and to notify facility personnel of the district/owner choosing when activated.

L. Modularm Model No. IP-1 (unless otherwise specified). Heated Illuminated Push Button Panic Alarm with protective cover and Phenolic Label “PANIC ALARM” for entrapment **within Freezer** (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if ‘inline’ assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium in location as directed by Architect). Division 27 will interconnect the Push Button Panic Alarm to the

Building Automation System for Owner notification. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsections F. Division 26 (**Electrical**) and G. Division 27 (**Communication**) for additional information.

M. KE2 Smart Access (unless otherwise specified). Confirm all component model numbers for complete installation and operation.

N. LED surface-mounted light fixture, in quantity/arrangement shown on drawings. Light fixtures to be perpendicular to coils. Light fixtures wired to interior and exterior temperature control panel. Light fixtures are to be provided by Section 11 40 00 and installed by Division 26. Division 26 is to seal all conduit penetrations at light fixtures. KEC to verify that penetrations are sealed.

O. Penetrations of Panels: To be sealed by factory installer and appropriate trade contractors, with Dow Corning 3-6548 silicone RTV foam, total depth of the panel. Trim excess flush. KEC to verify that all penetrations are sealed.

P. Install closure panels and trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.

Q. Compartment Entrance Doors: 36” x 78” nominal clearance unless otherwise noted.

1. Mount hinged doors on two Kason Model No. 1346; polished chrome-plated nylon cam-lift hinges. All doors to be equipped with polished chrome Kason 1094 or equivalent door closer assembly. Doors to be adjusted so all doors fully self-close.

2. Hinge doors as indicated on drawings.

3. Defrost heater: Thermostatically controlled and replaceable at the entire perimeter of all doors. Defrost heaters to be wired for continuous service.

4. 36” high x full-length diamond aluminum treadplate at front and rear of all hinged doors.

5. 12” x 2” engraved phenolic plastic compartment identification sign in Architect’s color selection with 1” letters, mounted above door window.

6. 14” x 24” four-panel glass view window with heater and molded non-metallic inner and outer frame. The heater is to be wired and controlled via the door monitor for continuous service.

7. Padlock/key provisions in the door latch with safety release mechanisms.

8. Kason 1826 Intelli-Vent LED Heated Pressure Relief Ports with Dual Port Vent and Security Light. Locate Two (2) 12” below ceiling on Cooler/Freezer common wall panel and Two (2) 12” below ceiling on Cooler wall panel. If Cooler and Freezer are separate units, locate one on the Freezer wall panel as well, 12” below ceiling and mounted in the door frame assembly. All ports to have separate dedicated electrical connections and be wired for continuous service. Located and installed by Manufacturer.

9. Kason Model No. 1238CQ (unless specified otherwise) Pacesetter Locking Handle QTLC polished chrome with Kason 0485 glow-in-the-dark backplate and turn knob safety release.

10. Manual backup vacuum release mechanism to punch 6” diameter hole in ceiling panel to release vacuum within freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in wall accordingly to assist with opening of door

assembly in the event of entrapment (and failure of inside release knob). Release mechanism assembly to be built-in/mounted to panel structural frame to minimize mechanism tear-out and/or failure. Handle to be glow-in-dark yellow with phenolic label “Vacuum Pressure Release.” Punch out portion to be replaceable in opening without the use of tools or sealants. Punch out is not to be located directly over interior ramp.

11. Provide Two (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. Walk-in manufacturer will install One (1) located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an ‘inline’ assembly) and provide the second unit loose for installation by Division 26 located in the Cafetorium (Division 26 to coordinate location with Owners and Architect). Division 26 is to provide all conduit and wiring required and interconnect the illuminated Push Button Panic Alarm in the Walk-In Freezer to both Strobe Beacons (***Critical***).

R. Provide refrigeration calculations and refrigeration alarm to meet local jurisdiction code requirements.

S. If air screens or air shields are specified above doors or on the interior of the assembly, the manufacturer must provide adequate blocking in panels to support these components and pre-wired electrical connections. Installer to coordinate location of door closure to not interfere with air screens or air shields. Clear-VU, swinging door assemblies, are not required if air shields are specified.

T. S/S trim above walk-in assembly to conceal manufacturer ceiling grid.

U. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment.

V. Walk-in Assemblies to be installed by the PRE-APPROVED INSTALLERS listed below:

1. QBR Refrigeration, 30083 Hwy 90 Blvd., Katy, TX 77493, Mr. Andy Spellins, 713-973-2875, andy.spellins@qbrsales.com

2. Machine Ice, 8915 Sweetwater Ln., Houston, TX 77037, Mr. Will Weaver, 281-448-7823

3. Coolers Inc., 6922 Alder Dr., Houston, TX 77081, Mr. Lee Mamone, 713-665-8886

2.34 WALK-IN COLD STORAGE ASSEMBLY REFRIGERATION SYSTEMS

A. Unit Coolers: specified quantity and model, ceiling-hung by ½” OD nylon bolts with stainless steel washers and nuts. Insert hanger bolts through the plastic sleeve and seal penetration airtight.

1. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drain pan outlet with union and cleanout plug and extension of 1” Type K copper drain line through wall panel to airgap fitting or floor drain under this Section.

2. Slope drain line ½” per foot, trap at the exterior of assembly and turn down into the drain. Manifold drain lines of adjacent compartments wherever possible.

3. Install drain line plastic sleeve through compartment wall, seal around drain line, and install stainless steel escutcheon with setscrews.

4. Electric drain line heater cable (self-regulating 7 watts): on all unit coolers operating below 36°F., installed from coil drain line fitting to wall penetration under this Section.

Heater cables: the minimum rating of 15 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2” loop spacing and interwire to unit cooler for continuous operation.

5. Mounted, pre-piped, and pre-wired evaporator components:

   a. Sporlan thermostatic expansion valve with external equalizer.

   b. Shut-off valve at evaporator suction and liquid lines.

   c. Sporlan “Catch-All” refrigerant filter/dehydrator on liquid line.

   d. White Rogers 1609-101 adjustable thermostat with remote bulb positioned in return airstream of the evaporator.

   e. Electrical disconnect switch in NEMA 4 enclosure.

   f. **For any facility within 20 miles of a salt air environment:** Condenser and Evaporators to be built with Electrofin coating to retard salt air deterioration. Coils are to be coated with Technicoat 10-2 coating for protection against a salt air environment.

   g. 110° Ambient Temperature Operation.

B. Refrigerant System Installation:

1. Refrigerant Lines; Type “L” rigid copper tubing. Fittings: Wrought copper or brass designed for use with high-temperature solder. Piping joints: Made with silver solder (Sil-Fos). Piping: Properly suspended from and anchored to the structure with adjustable hangers 6’ OC maximum. Suction lines: Sized to have a maximum pressure drop of two pounds in medium-temperature systems; one pound in low-temperature systems. Liquid lines: Sized to give maximum pressure to prevent trapping of oil. Insulation on all suction lines: Armaflex insulation by Armstrong. ¾” thick at medium-temp 1” thick at low temp. Refrigerant lines in PVC conduit: Sealed at both ends with Dow Corning 3-6548 silicone RTV foam. The refrigeration system installer will wrap Exterior Refrigerant Lines in the self-fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum strapping and seals for applying aluminum jackets and covers according to the manufacturer’s recommendations for a completely weather-tight covering.

C. Evacuation and Charging:

1. After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. Connections for evacuation: Following the manufacturer’s recommendations.

2. Charging after the initial charge, which is contained in the condensing unit (R448A Non-CFC Ozone Depletion Refrigerant for medium and high temp units, R513A - Non- CFC Ozone Depletion Refrigerant on low temp units) – (Refrigerant must meet District Standards, Industry Standards, and local Codes): given through the charging valve in the high side passing all of the liquid refrigerants through a charging dehydrator. All charging lines and gauges must be purged of air before connection with the system. Refrigerant: unused and shall be delivered in clean containers. After the system is fully charged: start and place it in full operation.

D. Refrigeration system to be installed by the **PRE-APPROVED INSTALLERS** listed below:

1. QBR Refrigeration, Mr. Andy Spellins 30083 Hwy 90 Blvd., Katy, TX 77493, 713.973.2875, andy.spellins@qbrsales.com

2. Machine Ice, Mr. Will Weaver, 8915 Sweetwater Ln., Houston, TX 77037, 281.448.7823

3. Coolers Inc., 6922 Alder Dr, Houston, TX 77081, Mr. Lee Mamone, (713) 665-8886

2.35 PRE-APPROVED KITCHEN EQUIPMENT CONTRACTORS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.

B. **Any contractor requesting inclusion within this bid must submit AIA form 305 a minimum of 14 days before the bid date for review or as required by Architect.**

1. Stafford Smith, Mr. JP Garcia, 7129 North Loop East, Houston, TX 77028, Phone: 713.892.5001, Email: jpgarcia@staffordsmith.com

2. Texas Metal Equipment Company, Mr. Travis Andrews, 23518 Coons Road, Tomball, Texas 77375, Phone: 713.466.8722, Email: tandrews@tmeco.com

3. Kirby Restaurant Supply, Mr. Brian Kernan, 809 S. Eastman Road, Longview, Texas 75602, Phone: 903.757.2723, Email: briank@kirbysupply.com

4. Mission Restaurant Supply, Mr. Robert Snoddy, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 832.970.4020, Email: roberts@missionrs.com

5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 409.769.1199, Email: terry@kommercialkitchens.com

6. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: 501.455.2552, Email: tim@supremefixture.com

7. Amundsen Commercial Kitchens, Mr. Lewis Beville, 105 Montie, Longview, TX 75604, Phone: 903.576.6354, E-mail: lewis@afeok.com

2.36 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid. Pre-approved fabricators shown below shall not sub-out fabrication.

B. **Any supplier requesting inclusion within this bid must submit AIA form 305 at least 14 days before the bid date for review or as required by Architect.**

1. Texas Metal Equipment Company, Mr. Travis Andrews, 23518 Coons Road, Tomball, Texas 77375, Phone: 713.466.8722, Email: tandrews@tmeco.com

2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 832.767.5287, Email: terry@kommercialkitchens.com

3. Mission Restaurant Supply, Mr. Robert Snoddy, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 832.970.4020, Email: roberts@missionrs.com

4. CSS Manufacturing, Mr. Jared Woodard, 7430 Fairbanks North Houston Rd., Houston, Texas 77040, Phone: 832.444.6311, Email: jared.woodard@css-mfg.com

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: Provide a skilled and proficient foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: Coordinate with the progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

1. Field-assembled fixed equipment integrated into the structure (e.g., walk-in assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks) are to be sent to the job site when directed by the General Contractor and installed or protected accordingly.

2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor, wall systems (including painting), and painted gas lines.

3. Major Movable Equipment: delivered, when possible, to inventory in a secured area for interim job-site storage or, if the secured area is unavailable when fixed equipment installation/clean-up has been completed.

4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) should be delivered only when the Owner is prepared to receive and inventory such items.

C. Installation: performed by the manufacturer of custom fabricated fixtures.

1. Assemble, square, level, and ready all items for the final utility connections.

2. Cut neatly around obstructions to provide sanitary conditions.

3. Where gaps of ¼" or less occur adjacent to or between equipment, insert rope backing and smoothly apply General Electric construction sealant Series SE-1200 silicone mastic (clear color). Mask both sides of the gap for neat sealant application and remove excess. If space exceeds ¼," neatly install 18-gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.

4. Refrigeration coil drain line runs to an indirect drain connection greater than 2" from the face of the wall or panel: Either of the following field procedures:

a. Trench the floor and provide a 6" wide x 2" deep 16-gauge stainless steel sloping (-1" to -2") trough from the face of the cooler/freezer wall to the body of the floor sink/floor drain. Trough: turned up 4" at the wall; ¾" flange with ½" turndown at both long sides. Set trough in waterproof mastic and seal 1" OD drain tube penetration into floor sink/floor drain at -2½" BFF. Patch the floor to match adjacent material/surface.

b. Provide 12" x 6" x 2" deep 16-gauge stainless steel condensate pan mounted to cooler/freezer wall at 6" AFF clear. Trench the floor and install a 1" OD drain line from the bottom of the pan to the body of the floor sink/drain. Slope drain line ¼"

per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

1. Fabricated fixtures: Fiberboard or plywood taped to tops and exposed body panels/components.

2. Manufactured Equipment: Fiberboard or plywood taped as required by equipment shape and installation-access requirements.

3. Prohibited use of equipment: Tool and materials storage, workbench, scaffold, stacking area, etc.

4. Damaged Equipment: Immediately documented and submitted to the Owner with the Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove all debris from this Work from the job site as the installation progresses.

B. Lubricate and adjust drawer slides, hinges, and casters.

C. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

D. Clean or replace faucet aerators and line strainers.

E. Touch-up damage to painted finishes.

F. Start up and check the operation of all refrigeration systems for at least 72 hours before acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Carefully test, adjust, and regulate all equipment following the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments, and performance are in full compliance.

B. Provide the Owner or food service Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected equipment items and attendees with the Owner at least two weeks before the demonstration starts.

3.4 FINAL OBSERVATION

A. Final observation will be made when the Contractor certifies that they have completed their work, thoroughly reviewed the installation/operation of each item in the contract and found it to comply with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated with it which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a $70.00/hr and expense basis.

PART 4 - EQUIPMENT SCHEDULE

4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS: Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT: Arrangement and configuration as shown on Plans, Elevations, Detail Drawings, and outlined in Specifications.

4.3 REFER TO DRAWINGS: For unit quantities and plumbing, electrical or mechanical provisions are required, including the manufacturer's optional voltages, wattages, burner capacities, etc.

4.4 REFER TO PART 2 – PRODUCTS: For accessories, fittings, requirements, and procedures related to the listed buy-out and fabricated equipment.

4.5 ALTERNATE MANUFACTURER REQUIREMENTS: A specific product manufactured by the listed pre-approved equals shown under Section 4.7 Food Service Equipment are acceptable only if the specific product can evidence compliance with the specified line items and the contract documents (Refer to Section 1.6; Sub-Section A.).

4.6 RE-USED EXISTING EQUIPMENT IF PROVIDED IN THIS PROJECT

A. Existing equipment scheduled for re-use is to be inventoried and documented that equipment is in operating condition once Kitchen Contractor has taken ownership.

B. Provide pictures of all equipment once inventoried and issue them to the architect to ensure that equipment has not been damaged.

C. Verify the locations of all equipment with the owner.

D. Existing equipment that is to be reused may need parts or accessories for proper and complete operation. Submit a report listing all items with pricing for approval to allow complete installation.

E. Utility disconnection and re-connection: Under Divisions 22 and 26. Kitchen Contractor to verify utility requirements of existing equipment and coordinate with Foodservice Design Professionals (FDP) as required. If utilities shown on FDP drawings do not match the requirements of existing equipment – KEC is to relay that to FDP immediately. All utilities not scheduled for re-use must be capped and covered by required disciplines.

F. Disassembly, removal, transportation, and relocation: under this Section and scheduled with General Contractor. The owner's representative must be present and coordinate the date/time with the owner.

G. Thoroughly clean inside and out before relocation.

H. Review functional parts (e.g., doors, controls, heating elements, compressors, etc.) and submit a report of required repairs and cost estimates. Any finishes or equipment damaged due to construction will be repaired as required.

I. Existing equipment not scheduled for reuse is to be carefully removed/relocated by the Kitchen Contractor per the Owner's direction. Kitchen Contractor to coordinate the date/time with General Contractor and Owner.

J. Removal or replacement of existing equipment is to be scheduled for times of least interruption and inconvenience to the food service operation. Submit the proposed time frame schedule, task sequence, and process for approval before starting work.

K. Kitchen Contractor to verify size and shape for all existing re-used equipment and coordinate with Foodservice Design Professionals (FDP) as required.

L. Any modification(s) required/desired for re-used existing equipment to be verified by the Kitchen Contractor. Before the changes are made, all modifications must be approved by the Owner and Foodservice Design Professionals (FDP).

M. The KEC is to verify and coordinate all the utility requirements with the construction documents as required. Refer to the general specifications regarding conflicts.

4.7 FOOD SERVICE EQUIPMENT

A. All equipment is to have a performance check from factory-authorized personnel. Warranties will begin on the day of the performance check.

B. All equipment and internal components should be of domestic origin where possible.

C. Architect to verify/coordinate the aesthetic options below (Food Service color, material, or signage selections) if these items are provided in this project:

1. Countertops: Stone (stainless steel is provided unless otherwise specified)

2. Tray slides: Corian or Stone (stainless steel is provided unless otherwise specified)

3. Counter fronts: Ceramic tile, 3 Form, or Plastic Laminate

4. Sneeze Guards: Stone insets

5. General color, material and graphic selections:

    a. Display Air Screen Merchandisers – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)

    b. Bakery Display Cases – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)

    c. Pass Thru or Reach-In Holding Cabinets - Color selection: Powder Coat (Mfg.: True) or Plastic Laminate (Mfg.: Traulsen) (Stainless steel is provided unless otherwise specified)

    d. Hanging Heat Lamps – Track and Fixture color selection

    e. Heated Merchandisers

    f. Portable Guide Rails – Stanchion and Belt color selection

    g. Popcorn machine – Signage selection

    h. Bottle Cooler – Signage selection

    i. Graphics Package information

    j. Hot Food Well covers

D. Architect to verify/coordinate the finishes below:

1. Walls: Ceramic Tile, Flat FRP, or Molded FRP (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)

2. Ceilings: Removable Vinyl Face Tile (Smooth, impervious, and easily cleanable as approved by local jurisdiction)

3. Floors: Tile, Epoxy, or Rubberized flooring system (Smooth, impervious, easily cleanable and slip resistant as approved by local jurisdiction) (Coordinate floor tile transition at serving lines)

4. Floors: Walk-in Assembly – Extend kitchen floor flush into Walk-in assembly with coved base

5. Furr Downs above Serving Counters

ITEM NO. 101 AIR SCREEN

QUANTITY 1

Manufacturer:	Mars
Model:	STD-2 Series
Size and Shape:	Refer to drawings
Alternate:	Berner

1. Air curtain, STD2 series model, unheated, obsidian black exterior. Size unit to fit door.
2. Air screen to be mounted at the exterior of the building at Receiving door.
3. Model 99-018 Reed Switch Kit. Commercial surface mounted magnetic door limit switch and the magnetic to be mounted on the surface of the door jamb and the door.
4. Confirm clearance above door prior to installation. Air Curtain to accommodate door width.
5. **Special Instruction:** 11 40 00 to provide magnetic reed switch kit loose to General Contractor for installation by Division 26. Division 26 to route flexible conduit to j-box on cabinet. Routing to be clean and secured to building.

ITEM NO. 102 COLD STORAGE ASSEMBLY

QUANTITY 1

Manufacturer:	Thermo Kool
Model:	---
Size and Shape:	Refer to drawings
Alternate:	RMI

1. Manufacturer to review final installation and provide a letter confirming installation meets manufacturer requirements.
2. KEC to provide written confirmation that all wall panels are properly anchored and no leaks are present at panels
3. Assembly to have 9'-6” interior clearance.
4. 304 #3 finish 20 gauge stainless steel finish where exposed, 26 gauge acrylume where concealed.
5. Factory floor with smooth aluminum finish, recessed in slab 8 1/2". Secure floor to wall assembly with cam-lock assembly. KEC to ensure the floor assembly is level prior to the wearing

bed installation. Kitchens finished floor to extend to walk-in. Critical: Floor to be smooth and level prior to concrete pour and at each stage of installation.

6. Threshold to be smooth and level with finished floor. Critical: Floor threshold to be surfaced with Graphine Oxide Anti-Slip or similar surface to reduce freezing and prevent slip hazards.
7. Interior walls to be baked white enamel embossed texture .040” aluminum.
8. Ceiling to be baked white enamel smooth textured .040” aluminum.
9. Two (2) 36" doors. Doors to be 20 gauge stainless steel, type 304 (18-8), #3 finish, with heated perimeter / door jambs / windows and threshold heaters. Each door to be equipped with 3'-0" high diamond tread kick plate on both sides of doors. Mount hinged doors on two (2) Kason model no. 1346 (or equal); polished chrome plated nylon cam-lift hinges. All doors to be equipped with polished chrome Kason 1094 or equivalent door closer assembly.
10. Each door to be equipped with 3'-0" high diamond tread kick plate on both sides of doors. Mount hinged doors on two (2) Kason model no. 1346 (or equal); polished chrome plated nylon cam-lift hinges. All doors to be equipped with polished chrome Kason 1094 or equivalent door closer assembly.
11. Provide foot treadles at each door.
12. Doors to be provided with CCI Industries, Inc., Clear-VU swinging door assemblies, Alternate: Kason.
13. Provide Kason model No. 1238CQ door handles with Kason 0485 Quarter Turn Frost Free inside release, glow in dark surface, tether to external strike mechanism, ADA compliant.
14. **Assembly to contain simple light switches only. Do not provide Manufacturers standard control panel.**
15. Provide solar powered digital thermometers at doors only.
16. Provide heated illuminated Push Button Panic Alarm with protective cover and Phenolic Label “PANIC ALARM” for entrapment within Freezer (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if ‘inline’ assembly) for installation of Emergency Strobe/Horn. Division 11 40 00 to provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium in location as directed by Architect) furnished loose for install by Division 26. Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification.
17. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side - interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob.
18. Manual backup vacuum release mechanism to punch 6” diameter hole in ceiling panel to release vacuum within freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in wall accordingly to assist with opening of door assembly in the event of entrapment (and failure of inside release knob). Release mechanism assembly to be built-in/mounted to panel structural frame to minimize mechanism tear-out and/or failure. Handle to be glow-in-dark yellow with phenolic label

"Vacuum Pressure Release." Punch out portion to be replaceable in opening without the use of tools or sealants. Punch out is not to be located directly over interior ramp.

19. 18-gauge stainless steel, type 304 (18-8), #3 finish trim where adjacent to walls and enclosure panels that extend to 2" above finished ceiling.
20. Freezer: One (1) lot LED light fixtures to operate in temperatures to -20 F. Lights to be installed perpendicular to coils.
21. Cooler: One (1) lot LED light fixtures. Lights to be installed perpendicular to coils.
22. Provide door bumper at doors.
23. Interior and exterior to be sealed with clear silicone. Stainless steel surfaces can be sealed factory approved waterproof and mildew resistant aluminum based metallic sealant.
24. 3'-0" high diamond tread plate at exposed exterior surfaces. Fasten to wall with stainless steel fasteners.
25. All penetrations in assembly to be sealed by appropriate trades. Ensure all penetrations for temperature probe, fire suppression, lights, refrigeration conduit, etc. are sealed. KEC to confirm all penetrations are sealed.
26. K.E.C. to provide aluminum cove base to interior of assembly. Provide sealant between floor and wall panels.
27. Provide Manufacturers alarm/control system that includes hi/low limits. Route temperature sensor to be located to the side of evaporator coil.
28. If RDT provides the KE2 Eco-Smart controller, CSA manufacturer to provide foamed in place j-box for Refrigeration System's K-2 Controller. Locate above Cooler and Freezer doors at exterior of assembly, to be flush with face of assembly wall.
29. KEC to coordinate location of network switch with cold storage assembly as required.
30. Kason 1832 Large Spring Valve Heated Pressure Relief Port. Locate at 12" below ceiling on cooler/freezer common wall panel and at 12" below ceiling on exterior cooler wall. All ports are to have separate dedicated electrical circuits. Pressure relief ports to be wired for continuous service. Relief port to be located, sized, and installed by Walk-in Manufacturer.
31. KEC to field verify all horizontal/vertical measurements and conditions at the building prior to fabrication or delivery of equipment.
32. KEC to provide 1-year walk-in panel installation warranty. KEC is responsible for overall install accuracy/quality and quality control of work performed regardless of installer or any field modifications due to building/construction conditions. KEC to provide Letter of Install Approval to FDP upon completed install.
33. Manufacturer to provide One Year Parts and Labor Warranty upon receipt of warranty letter.
34. Interwiring of temperature monitor panel to master building alarm system or to the Owner's network. Technology department to provide all interfacing of alarm system and with the building alarm system. Conduit from refrigeration system to monitor by Division 26. Temperature Monitor installation at 4'-0" above finished floor. All conduit to be located above walk-in cooler/freezer ceiling. Exposed electrical conduit is not acceptable.
35. Installer to route temperature sensor to be located to the side of evaporator coil.
36. Interconnect with Owner installed Cooper Atkins Temp Trak monitors. Refer to Item 102.2A.

37. Manufacturer Representative to provide training on controls and inside emergency release mechanisms.
38. Note to 11 40 00: Evaporator and Condenser Coils to be coated with Technicoat 10-2 coating for protection against salt air environment. Refer to Item 103 Cold Storage Refrigeration system.
39. Electrical conduit for lights to be exposed, ran from fixture to fixture with no penetration in ceiling panel. Tap off existing light fixture circuit at door. Div. 26 to provide watertight conduit for lights.
40. **Special Instruction:** Conduit from refrigeration system to monitor by Division 26. Temperature Monitor installation at 4'-0" above finished floor. All conduit penetrations to be through the walls, no ceiling penetrations for lighting (exception for evaporators, sprinklers, Temp alarm probes). 8" - 10" air gap around unit. Engineers to provide air flow/ventilation in gap to reduce potential of condensation/mold.

ITEM NO. 102.2 COLD STORAGE MONITORING SYSTEM

QUANTITY 1

Manufacturer:	Cooper Atkins
Model:	Temp Trak
Size and Shape:	Refer to drawings
Alternate:	---

1. Temp Trak system to be provided by 11 4000, installed by Alvin ISD.
2. 1 each 10000 PDT 900 mHz Intelli-Base Buffer.
3. 1 each 100000 US 900 mHz Base Station Receiver.
4. Provide components for all required refrigerated equipment. Refer to Item 102.2A
5. 11 40 00 to turn over system at time of facility punch for all components to be accounted for.

ITEM NO. 102.2A COLD STORAGE MONITORING SYSTEM -PROBES

QUANTITY 4

Manufacturer:	Cooper Atkins
Model:	Temp Trak
Size and Shape:	Refer to drawings
Alternate:	---

1. Temp Trak system to be provided by 11 40 00, installed by Alvin ISD.
2. Provide the following components to accompany Item 102.2
3. 1 each for Walk-In Freezer, Walk-In Cooler and ALL Refrigerated Holding Cabinets, Refrigerated Merchandisers:
    a. 10080 DT 900 mHz Dual internal-external Temperature Transmitter.
    b. 2033 standard air temperature probe.
    c. 10110 900 mHz Transmitter enclosure.
    d. Provide (1) transmitter for each walk-in compartment, refrigerated holding cabinets and Refrigerated Merchandisers. Refer to drawings for quantity and locations of equipment to be monitored.
4. 11 40 00 to turn over system at time of facility punch for all components to be accounted for.

ITEM NO. 103 COLD STORAGE REFRIGERATION SYSTEM

QUANTITY 1

Manufacturer:	RDT
Model:	ZS1-2 EcoSmart
Size and Shape:	Refer to drawings
Alternate:	Cold Zone

1. Outdoor Air cooled system.
2. Scroll Compressors.
3. Cooler temperature to be +35 degrees.
4. Freezer temperature to be -10 degrees.
5. Separate fans on either shared or independent condensers.
6. EcoSmart system on demand defrost.
7. *KE2 Evap Controllers located per Owner requirements. .If providing KE2 Eco Smart, controller to be mounted at exterior of assembly, above the door, and LAN connection is to be provided. If providing EcoNet defrost controller, the remote monitoring control to be located in Managers office above light switch.*
8. Condenser and Evaporators to be built with Electrofin coating to retard salt air deterioration. Coils to be coated with Technicoat 10-2 coating for protection against salt air environment.
9. Refrigeration system to accommodate 110F ambient exterior temperature. Coils to be oversized by 20%.
10. S/S covered housing.
11. A dedicated electrical connection to be provided for heated condensate drain line. Refer to electrical plan for location.
12. All exterior piping to be aluminum wrapped.
13. System to accommodate Item No. 102 Cold Storage Assembly.
14. S/S covered housing mounted to a 24" tall 1/8 galvanized angle iron frame anchored to concrete pad. Base to be open with no skirting.
15. Mount condensing unit on common exterior rack. Refer to Architectural and Engineering drawings for exact location of remote unit. Coordinate routing of refrigeration lines and conduit with appropriate trades. Heat tape and insulate all drain lines. General Contractor to seal all building penetrations at refrigeration lines.
16. All field installed exterior piping to be aluminum wrapped by installing contractor. **All interior refrigeration lines to be insulated, Condensate drain lines at Cooler to be insulated and drain lines in Freezer to be heated and insulated. Refer to section 2.34 B for insulation requirements.**
17. Provide two (2) year parts and labor warranty for all parts and components (including third-party components that may be utilized).

ITEM NO. 104 COLD STORAGE SHELVING

QUANTITY 16

Manufacturer:	Metro
Model:	Metro Max Q
Size and Shape:	Refer to drawings
Alternate:	Cambro Camshelving

1. Each unit to be four (4) tiers high with open grid mats.
2. Four (4) 74" post per unit. Provide foot plates at all posts when assembly is supplied with walk-in floor.
3. Refer to drawings for size, width and lengths. Maximize shelving to allow not more than 6" tolerance.
4. **Special Instruction:** Verify shelving requirements with approved submittal prior to ordering.
   11 40 00 to list dimensions on shelving units for rough in submittal.

ITEM NO. 105 DUNNAGE RACK

QUANTITY 7

Manufacturer:	Metro
Model:	Bow Tie Series
Size and Shape:	Refer to drawings
Alternate:	Cambro Camshelving Slotted

1. Size as shown.
2. **Special Instruction:** Verify shelving requirements with approved submittal prior to ordering.
   11 40 00 to list dimensions on shelving units for rough in submittal.

ITEM NO. 107 DRY STORAGE SHELVING

QUANTITY 11

Manufacturer:	Metro
Model:	MetroMax Q
Size and Shape:	Refer to drawings
Alternate:	Cambro Camshelving

1. Each unit to be five (5) tiers high with open grid shelving.
2. Four (4) 86" posts per unit.
3. All shelving shown within the dry storage room.
4. Refer to drawings for size, width and lengths. Maximize shelving to allow not more than 6" tolerance.
5. **Special Instruction:** Verify shelving requirements with approved submittal prior to ordering.
   11 40 00 to list dimensions on shelving units for rough in submittal.

ITEM NO. 108 CAN RACK

QUANTITY 2

Manufacturer:	New Age
Model:	1250CK

Size and Shape: Refer to drawings
Alternate: ---

1. Three (3) sets 1255, of shelf inserts to accommodate # 5 and # 10 cans.
2. Four (4) casters with brakes.

ITEM NO. 109 ICE MAKER W/ BIN

QUANTITY 1

Manufacturer: Hoshizaki
Model: F-1002MAJ-C / B-500
Size and Shape: Refer to drawings
Alternate: ---

1. One (1) Hoshizaki F-1002MAJ-C ice maker (sonic style ice).
2. One (1) B-500 stainless steel bin with 6” stainless steel legs. Coordinate ice drop zone. Coordinate bin top kits as required.
3. Air cooled.
4. One (1) probe and rake tool set.
5. Interconnect through Item 813 Remote Water Filter**.** Provide stainless steel flex connection to ice machine.
6. Provide One (1) Vollrath model no. 46893 40 oz. Capacity Ice Scoop.
7. Provide One (1) Vollrath model no. ISH-567 64 oz. Capacity Ice Scoop holder. Holder to be mounted to wall next to ice machine in an easily accessible location. Location to be coordinated with Owners prior to being mounted to wall.
8. **Special Instruction:** Coordinate cord and cap with receptacle. 60" long flex hose from filtered water connection to ice maker with 48" wall restraint cable. Interconnection thru water filter to ice machine and final connection by Division 22. Provide one (1) floor sink only, half underneath eqmt. footprint to be accessible for clean-out.

ITEM NO. 110 CLOTHES WASHER

QUANTITY 1

Manufacturer: Owner Furnished
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. 11 40 00 to provide washer installation kit.
2. Final connections by Div. 22 & Div. 26. Coordinate with G.C.
3. Unit to be located on 4" tall housekeeping pad per drawings. Coordinate size of pad with size of equipment.
4. **Special Instruction:** Verify utility requirements with owner/operator.

ITEM NO. 110A CLOTHES DRYER

QUANTITY 1

Manufacturer:	Owner Furnished
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. 11 40 00 to provide dryer installation kit.
2. Final connections by Div. 26. Coordinate with G.C.
3. Unit to be located on 4" tall housekeeping pad per drawings. Coordinate size of pad with size of equipment.
4. **Special Instruction:** Verify utility requirements with owner/operator.

ITEM NO. 111 CHEMICAL SHELF

QUANTITY 2

Manufacturer:	Metro
Model:	MetroMax Q
Size and Shape:	Refer to drawings
Alternate:	Cambro Camshelving

1. Each unit to be four (4) tiers high with open grid mats.
2. Four (4) 72" posts per unit.
3. 11 40 00 to coordinate size and location of shelving.

ITEM NO. 121 TWO COMPARTMENT SINK W/DISPOSER

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S marine edge with 2" turndown at free sides.
2. Open base construction.
3. 10" high splash where adjacent to walls/fixtures.
4. Two (2) 24" x 26" x 15" deep sink compartments.
5. One (1) T&S model no. B-0291, splash mount faucet, 18" swing nozzle,LL inlets, for ¾" hot and cold water connections.
6. Two (2) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. Provide One (1) T&S model no. B-0133-EE pre-rinse, w/ Add-A-Faucet assembly**,** B-0108-C spray head, two(2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
8. 16 gauge S/S undershelf per drawings.

9. Disposer - installed in top integrally welded disposer cone. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top for disposer control panel ground and polished to match top.
10. 12" deep single post mounted perforated overshelf at 18" above countertop. Stop shelf per drawings.
11. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Stop rack per drawings. Verify height with owner.
12. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S flanged ground and polished to match top. Hose and spray nozzle by owner.
13. Omit rear rail at sink compartments, disposer and front rail at hose bibb.
14. Two (2) "Richlite" ½" thick removable sink covers installed at each sink. Weld ¼" bar stock, set 5/8" below work surface at all four corners for support of sink covers. Two (2) finger holes per board.
15. Provide top and bottom c-channel support storage for sink covers at left end of counter, opposite can opener location.
16. One (1) Edlund model no. S-11 Manual can opener, mounted on raised platform.
17. Flanged feet at front only.
18. Seal at all splash penetrations.
19. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**
20. **Special Instructions:** All floor sinks to be accessible.

ITEM NO. 123 DISPOSER-CONE MOUNT

QUANTITY 2

Manufacturer:	Red Goat
Model:	BP3-R
Size and Shape:	Refer to drawings
Alternate:	---

1. 3.0 hp motor w/ 18” stainless steel cone.
2. RAC2 Control with mounting bracket.
3. Fixed nozzle.
4. Vacuum breaker.
5. Solenoid valve.
6. Scrap ring.
7. Water swirl nozzle.
8. Auto-reverse.
9. Dejamming tool.
10. Cone cover.
11. Install vacuum breaker in splash.
12. Swirl inlet located in disposer cone at a 45 degree angle.
13. Neither Salvajor nor Insinkerator are an acceptable alternate.

14. **Special Instruction:** GC to pipe 1/2" cold water to swirl inlets and disposer body. Excess electrical cord to be secured to fabrication as required.

ITEM NO. 125 20 QT. MIXER W/ STAND

QUANTITY 1

Manufacturer:	Hobart
Model:	HL200
Size and Shape:	Refer to drawings
Alternate:	---

1. Food mixer, Bench Model, 1/2-HP motor, 20 qt. Capacity.
2. 115/60/1 ph.
3. 15 minute timer.
4. Epoxy enamel finish-bench model.
5. One (1) 20 qt. S/S bowl.
6. One (1) 20 qt. Aluminum "B" flat beater.
7. One (1) 20 qt. S/S "D" wire whip.
8. One (1) 20 qt. "ED" dough hook.
9. One (1) 20 qt. Lexan splash cover.
10. One (1) 20 qt. bowl guard with ingredient chute.
11. One (1) VS9-12 9" Vegetable Slicer, #12 back case, hopper front, and adjustable slicer plate.
12. One (1) #12 plate holder.
13. One (1) grater plate.
14. One (1) Shredding Plate, 3/32".
15. One (1) Shredding Plate, 3/16".
16. One (1) Shredding Plate, 5/16".
17. One (1) Shredding Plate, ½".
18. Stand to be Pre-Drilled to accommodate Mixer.
19. One (1) Caddy model no. T-242 mobile mixer stand, with casters, two (2) with brakes. Secure mixer to table with non-corrosive bolts. Alternate-Custom Fabricated, New Age.

ITEM NO. 126 WORKTABLE W/ SINK

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S, 2" turn down at all sides.
2. Open base construction.
3. One (1) 15" x 18" x 10" deep sink compartment. Coordinate location with drain overflow.
4. One (1) T&S model no. B-0320-BB-CR , rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections.
5. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece

6. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. Omit rear crossrail at sink section.
8. Flanged feet at front legs.
9. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**

ITEM NO. 127 SLICER W/ STAND

QUANTITY 1

Manufacturer:	Hobart
Model:	HS9N-1
Size and Shape:	Refer to drawings
Alternate:	---

1. One (1) high/low fence assembly.
2. Tubular S/S food chute.
3. Cord and plug.
4. One (1) mobile Caddy Model No. T-243-A slicer stand with locking casters. Pre-Approved Equal: EPCO, Lakeside.
5. One (1) stainless steel cord hanger by foodservice equipment contractor attached to stand.

ITEM NO. 128 UTILITY CART

QUANTITY 3

Manufacturer:	Lakeside
Model:	543
Size and Shape:	Refer to drawings
Alternate:	Vollrath

1. Four (4) N.S.F. approved non-marking casters, Two (2) with brakes.
2. Corner bumpers.

ITEM NO. 130 WORKTABLE

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S, 10" high backsplash at walls, 2" turndown at free sides. Close back of splash when exposed.
2. Open base construction.
3. 16 gauge S/S undershelf.
4. Two (2) 20" W x 20" L drawer assemblies. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
5. 6" S/S adjustable feet.

ITEM NO. 136 BAKER'S TABLE

QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Provide finished back at exposed end and backsplashes.
2. 12" deep post mounted overshelf at 18" above counter top
3. 16 gauge S/S flour trough
4. Rear rail only
5. One (1) enclosed 3-tier drawer base. Drawers to be non-locking.
6. One (1) lot Rubbermaid no. FG360288WHT ingredient bins.
7. 14 Gauge S/S top with 2" square turn down at front, 8" high enclosed splash at both sides and rear
8. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**

ITEM NO. 138 PAN RACK QUANTITY 2

Manufacturer: CresCor
Model: 100-184-1DSD
Size and Shape: Refer to drawings
Alternate: Wilder

1. Perimeter bumper.
2. Solid bottom.
3. Four (4) 6" polyurethane casters, Two (2) with brakes per unit.
4. Full length door with gravity latch.

ITEM NO. 139 INSUL MOBILE PROOFER QUANTITY 1

Manufacturer: Cres Cor
Model: H-137-WSUA-12D
Size and Shape: Refer to drawings
Alternate: Winston HOV3

1. Insulated proofer/heated cabinet.
2. Controls to be mounted at top of unit.
3. Field reversible doors.
4. Adjustable universal angles.
5. Four (4) 5" casters, two (2) with brakes.
6. Tempered glass door windows.
7. Corner bumpers.
8. Cord and plug. Coordinate NEMA configuration with Electrician.
9. Thermometer.
10. 1500 watt heater.

ITEM NO. 146 100 LB. BLAST CHILLER

QUANTITY 1

Manufacturer: Irinox
Model: EASYFRESH NEXT LL
Size and Shape: Refer to drawings
Alternate: ---

1. Self contained reach-in blast chiller.
2. One (1) temperature probes.
3. Two (2) Blast Chilling and Two (2) Shock freezing cycles, Delicate and Strong.
4. Touchscreen display.
5. Sanigen Sanification sanitizing system.
6. Internal condensate evaporator
7. Manual defrosting.
8. Provide **non**-locking door handle as available.
9. Capacity: Twenty-six (2) 12" x 20" x 2 1/2" pans or eighteen (18) 18" x 26" sheet pans.
10. Swivel casters, two (2) with locks.
11. Stainless steel finished back.
12. Cord and plug set.
13. Unit MUST CONTAIN CORROSION RESISTANT EVAPORATOR COIL OR WILL NOT BE ALLOWED

ITEM NO. 151 FIRE PROTECTION SYSTEM

QUANTITY 2

Manufacturer: BY MECHANICAL CONTRACTOR
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

ITEM NO. 152 EXHAUST HOOD

QUANTITY 1

Manufacturer: BY MECHANICAL CONTRACTOR
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

ITEM NO. 153 EXHAUST HOOD

QUANTITY 1

Manufacturer: BY MECHANICAL CONTRACTOR
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

ITEM NO. 161 CONVECTION OVEN

QUANTITY 1

Manufacturer: Blodgett
Model: DFG-200 DBL

Size and Shape: Refer to drawings
Alternate: Southbend

1. Bakery Depth cavity.
2. S/S front, top and sides.
3. Two (2) 1/2 HP 2-speed motors.
4. Natural gas.
5. SSI-M solid state infinite control with manual timer.
6. Electronic spark ignition.
7. Five (5) oven racks per compartment.
8. Dual pane thermal windows.
9. Simultaneous door operation.
10. Heavy duty casters, two (2) with brakes.
11. Heat Shield kit, install at side facing aisleway.
12. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48" Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
13. Dedicated gas connections, do not manifold.
14. Shunt trip breaker by Division 26.
15. Provide dormont, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot.

ITEM NO. 164 40 GA. TILT BRAISING PAN - MANUAL TILT

QUANTITY 1

Manufacturer: Groen
Model: BPM-40GC
Size and Shape: Refer to drawings
Alternate: Vulcan

1. Natural gas.
2. Manual tilt.
3. Electronic ignition.
4. Classic controls.
5. Pan Carrier.
6. Provide Caster Kit with locks.
7. **Double pantry swing faucet w/60" hose. Hose to have Gooseneck nozzle with locking ring.**
8. Lip strainer.
9. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48" Gas Conn. Kit, 48" long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
10. Provide flex water hose from water connection to faucet.

11. Trench Liner to consist of:
12. S/S trench liner by 11 40 00. Installation by G.C.
13. Custom Fabricated or IMC/Teddy.
14. IKG grating type “D”. Grating to be in two (2) equal removable sections.
15. 1-1/2” x 3/16” bearing bars and perimeter frame. Provide in two (2) pieces.
16. 14 gauge s/s liner
17. Klein no. 1834-1010-100 basket drain.
18. Klein no. 1870-1001-3251 safety chain.
19. Location of trench liner is critical. G.C. and 11 40 00 to verify location prior to concrete pour. Oversize trench liner block out to accommodate equipment pour path.
20. **Special Instruction:** Coordinate trench liner location with pour path.

ITEM NO. 165A TWO BURNER RANGE

QUANTITY 1

Manufacturer:	Southbend
Model:	12-2BN
Size and Shape:	Refer to drawings
Alternate:	Vulcan, Garland

1. S/S sides and front.
2. Cabinet base with removable shelf.
3. Removable cast iron grates.
4. Removable drippings tray.
5. 1" rear gas connections.
6. 5" gas flue riser.
7. External pressure regulator.
8. One (1) 4'-0" long quick gas disconnect kit with 3'-0"security cable.
9. S/S front end caps at manifold.
10. Provide integral model no. PC-S with T&S faucet 43-073.
11. Casters.
12. Spark igniter.
13. Flame failure feature.
14. Provide dormont, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot.

ITEM NO. 167 MOBILE WORKTABLE

QUANTITY 4

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. At one (1) table only, located to the side of Item 174 Conveyor Oven: table height to match lowest conveyor oven shelf. Recessed top per drawings to accommodate cutting board. Cutting board to be flush with rest of table. Cutting board to be ½" thick richlite.
2. Top: 14 gauge type 304 S/S with 2" turndown at all sides.
3. Open base construction.
4. 16 gauge S/S undershelf per drawings.
5. 5" N.S.F. approved non-marking swivel casters, two with brakes.
6. One (1) or Two (2) 15" x 20" drawer assemblies, 200 lb. drawer slides. Drawers to be non-locking. Refer to drawings for requirements.
7. Refer to section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**

ITEM NO. 168 S/S WALL CAP

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. 2" square turndown at free ends.
2. Caulk and seal at wall with clear silicone.
3. Eased edges at exposed corners.
4. Coved turn up at full height wall, extended to ceiling.
5. Locate per drawings.
6. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**

ITEM NO. 172 COMBI OVEN

QUANTITY 1

Manufacturer:	Rational
Model:	ICP 6-FULL/6-FULL N/G
Size and Shape:	Refer to drawings
Alternate:	Alto-Shaam, Henny Penny

1. Pre-Installation Site Consultation, to verify building utilities and access are in place for the units ordered prior to units being installed on site.
2. Programmable for varied menus. Internet and mobile app programmability functions required.
3. 208/240V 1PH
4. Doors hinged on right.
5. Six (6) 18" x 26" or twelve (12) 12" x 20" pan capacity, per unit.
6. Standard warranty: 2 year parts and labor, installation inspection/start up.
7. Doors hinged per drawings.
8. Combi-Duo Stacking Kit, mobile.
9. Tablet based cleaning chemicals to be provided only. Do not provide liquid chemical containers.
10. Cleaner Tablets.
11. Care Tablets.

12. Gastronorm Grid Shelf, qty. 3.
13. Fry baskets, qty. 3 per oven.
14. KEC to coordinate pan accessories with Owner prior to ordering.
15. Four hour chef training.
16. Heat shield.
17. Installation Kit "10", per unit, article number 8720.1560US.
18. Rational offers Certified Installation of units by Commercial Kitchens.
19. System installation to be reviewed by an authorized factory installer, provide report confirming installation meets factory's requirements.
20. System to be interconnected to remote Reverse Osmosis System, Item 812. KEC to coordinate with G.C. and Div. 22.
21. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to Combi Oven,color coded for filtered and non-filtered water.
22. KEC to coordinate filtered and unfiltered water with Combi Oven, do not connect filtered water to unfiltered water connection.
23. Provide quantities and sizes required: Dormont Model #VER-KIT-2S-48” Gas Conn. Kit, 48” long, Moveable Gas Connector Kit, covered with stainless steel braid, coated with blue antimicrobial PVC, SnapFast® Quick Disconnect, Swivel MAX®, full port valve, coiled restraining cable with hardware, limited lifetime warranty.
24. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.
25. Water supply to have shut-off valve and back flow preventer furnished and installed by Division 22. Supply water to interconnect thru water filter and then to each oven. Indirect drain line to be ran outside of the footprint of the unit, coordinate location of the related floor sink.

ITEM NO. 174 CONVEYOR OVEN

QUANTITY 1

Manufacturer:	Lincoln
Model:	1116-000-U-K1835
Size and Shape:	Refer to drawings
Alternate:	Middlby-Marshall

1. Two (2) stacked ovens with stacking kit.
2. Two (2) straight take-off shelves per oven tier.
3. Provide Fast Bake option.
4. Thermal insulated top.
5. Spare parts kit.
6. Four (4) casters with brakes.
7. Two (2) 4'-0" long quick gas disconnect kit with 3'-0" security cable.
8. Natural gas.

9. Two (2) gas pressure regulators.
10. Fire Suppression nozzles are not to be secured to Conveyor Oven shelves unless mandated by Fire Marshall during inspection.
11. Provide dormont, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot.

ITEM NO. 184 MICROWAVE

QUANTITY 1

Manufacturer:	Panasonic
Model:	NE-3280
Size and Shape:	Refer to drawings
Alternate:	Amana

1. **Special Instruction:** Coordinate cord and cap with receptacle.

ITEM NO. 187 PASS-THRU HEATED CABINET- 2DR

QUANTITY 2

Manufacturer:	Utility
Model:	HC-60-SS-4S-4S-D
Size and Shape:	Refer to drawings
Alternate:	Continental

1. S/S interior and S/S exterior.
2. 208/60/1-ph, Provide cord and plug. Coordinate NEMA plug requirements with Div. 26.
3. Interior lights with bulbs.
4. Digital temperature control
5. Universal guide slides to accommodate 18" x 26" and 12" x 20" food pan files on 4" centers in all sections.
6. 6" high adjustable S/S legs.
7. Five year parts, one year labor warranty, lifetime telephone tech support, standard.
8. Controls mounted on kitchen side.
9. 12" high top mount.
10. 11 40 00 to provide fully welded telescoping S/S trim at wall. Trim is not to be secured to the equipment.
11. 11 40 00 to provide Stainless steel removable trim panel located between wall and top of cabinet.
12. **Half height doors hinged as per plan.** Doors on servery side and kitchen side to be stainless steel.
13. **Special Instructions:** Provide opening in wall 12" taller than equipment, KEC to coordinate with GC as required.

ITEM NO. 189 PASS-THRU REFRIGERATOR - 2DR

QUANTITY 2

Manufacturer:	Utility
Model:	PT-R-60-SS-4S-4S-D
Size and Shape:	Refer to drawings
Alternate:	Continental

1. S/S interior and S/S exterior.
2. LED lights only
3. Digital temperature control.
4. 115v/60/1-ph,
5. Universal guide slides to accommodate 18" x 26" and 12" x 20" food pan files on 4" centers in all sections.
6. 6" high adjustable S/S legs.
7. Top mounted refrigeration.
8. Five year parts, one year labor warranty, lifetime telephone tech support, standard
9. Five year compressor warranty.
10. Controls mounted on kitchen side.
11. 11 40 00 to provide fully welded telescoping S/S trim at wall. Trim is not to be secured to the equipment.
12. 11 40 00 to provide Stainless steel removable trim panel located between wall and top of cabinet.
13. **Half height doors hinged as per plan.** Doors on servery side and kitchen side to be stainless steel.
14. Interconnect with Owner installed Cooper Atkins Temp Trak monitors. Refer to Item 102.2A.
15. Provide cord and plug. Coordinate NEMA plug requirements with Div. 26
16. **Special Instruction:** Provide opening in wall 12" taller than equipment, KEC to coordinate with GC as required.

ITEM NO. 201 SERVING COUNTER

QUANTITY 1

Manufacturer:	CounterCraft
Model:	---
Size and Shape:	Refer to drawings
Alternate:	Mod-U-Serve

1. One (1) each CounterCraft SCOL model, semi-enclosed base counter, size and shape per plan.
2. Stainless steel utility riser, integral to countertop, extend from 10'-0" ceiling height. Accommodate electrical to Load Centers and Data for POS stations.
3. Countertop to be constructed with 14-gauge stainless steel at 34" a.f.f.. #4 high polished edge accents, turn down at all free sides. Counter top at beginning of each line to be recessed to 32" A.F.F. for tray pass.

4. Group "E" corian trayslide with no s/s runners nor buttons @ 30" A.F.F. Trayslide to be supported with finished plywood with white melamine at exposed areas. Trayslide brackets to be fully welded to angle iron frame. **Coordinate Color/Pattern of Corian with Foodservice Director and Architect**. Provide lights below trayslide.
5. LED tamper proof lighting located under trayslide pre-wired to single switch located in control panel.
6. Counter front to consist of plastic laminate panels, positioned on standoffs. Stainless steel body, 1" reveal between panels. Panels provided and installed by Counter Manufacturer. **Coordinate color and pattern with Foodservice Director and Architect**.
7. Coordinate counter to ensure clear access to all floor sinks at staff side.
8. Fully welded angle iron frame utilizing 1.5" x 1.5" x 1/8" galvanized angle. Welds to be ground smooth and sprayed with silver enamel paint. Angle Iron to be framed around each cutout for drop-in-equipment. Angle iron to run front-to-back and at each mullion. 1/2" sound deadening tape to be applied to top of angle iron frame prior to installation of countertop.
9. All stainless steel fabrication to be fully welded. Butt or knuckle joints will not be accepted. Tops must be fully re-grained for a consistent appearance. All radius edges of turn down to have a minimum 3/8" #8 finish.
10. Stainless steel internal shelving compartments, fully enclosed back, sides, and top. Removable rear access panels, removable top panel, coved corners All internal stainless steel fabrication to be fully welded.
11. All electrical to be interconnected to load center. Electrical to be located in electrical conduit pipe, flex conduit to be kept to a minimum. Exposed flex conduit will not be accepted. All wiring to be numbered at all junctions, per circuit. Wiring diagram to be provided at each load center door. All receptacles mounted in the counter to be recess mounted and labeled.
12. Two (2) Load Center Compartments located per drawings. Coordinate with electrical at utility chase.
13. Counter Manufacturer to provide and install stainless steel utility chase from ceiling down through Counter body for electrical to Load Center and data for POS units.
14. Custom control panel containing remote mounted controls for drop-in equipment (i.e. hot food wells, cold pans, etc), custom CounterCraft labeling and switches. **Control panel assembly location is not to impede maintenance access to hot food wells. District must be able to service / change heating element without removing hot food well from counter. Locate control panel to the side - not in front - of the Hot Food Wells.**
15. Provide louvered doors at compressor compartments located on both sides of counter.
16. All doors in counter to be easily opened service doors.
17. Two (2) convenience outlet in each control panel.
18. One (1) BGA SERIES (or comparable design). breath protector with mirror finished posts and two tier glass display shelf, with bottom tier being a Frost Top overshelf. All refrigerant lines and electrical lines to be concealed within the upright post. Top shelf to be glass. All breath protectors to meet current N.S.F. standards. Display lights at frost top. Breath protector glass **on all tiers** to be fully adjustable, full service to self service.

19. Two (2) custom CounterCraft single-tier adjustable series breath guards with #8 mirror finish stainless steel post. Posts to extend through the countertop and securing to the angle iron frame within the counter body. 3/8" tempered glass front and side panels. Glass is to have high polish profiled edges with rounded corners. Includes heat and LED lights as required, adheres to current NSF standards.
20. Two (2) custom CounterCraft vertical series breath guards with #8 mirror finish stainless steel post, modified post top to have a slight angle towards the rear of the counter. Posts to extend through the countertop and secure to the angle iron frame within the counter body. 3/8" tempered glass front and angle section. Glass is to have high polish profiled edges with rounded corners. Does not include heat or LED lights. Adheres to current NSF standards.
21. Two (2) CounterCraft dual-tier HotFrost™ Glass Overshelf, GOVS-2 **two-pan capacity**, frost-only configuration. Overshelf to be configured with adjustable front glass on lower tier; no glass on the upper tier. #8 mirror finish stainless steel post. Posts to extend through the countertop and securing to the angle iron frame within the counter body. All glass to be 3/8" tempered and to have high polish profiled edges with rounded corners. Intermediate glass shelf to include a custom recessed frost top shelf, **sized for two (2) 18X26" sheet pans**. Intermediate shelf to have a slight slope towards the customer and to be modified 6" lower to accommodate student reach. Includes an electronic temperature control, self-contained condensing unit and 1/4 HP compressor. Includes LED lights on both tiers.
22. Ten (10) each electric hot food wells, fully insulated, 1200 watts, thermostatic controls with lit rocker switches (remote mount in custom CounterCraft control panel), pre-plumbed drain manifold with custom CounterCraft open/close drain valve assembly. Individual 3/4" turn ball drain valve at each hot food well, manifolded drain lines to a single 3/4" turn ball valve mounted in full stainless-steel housing. Drain valve to be located on operator side for ease of access. Hot food wells to be located in a 1" recess within the counter top.
23. Bon Chef hot food well covers. **Verify color selection with Foodservice Director and Architect.**
24. Provide 8" wide stainless steel work shelf on fold-down brackets at Tray Pass sections, beginning of line
25. Two (2) each recessed heated shelves, size, shape and location per plans.
26. Provide Two (2) integral cashier stations. Provide closed base below with intermediate and bottom shelf. Extend bottom shelf of cashier stand for foot rest. Outlet for CPU unit to be located above intermediate shelf within cashier stand facing user. Provide grommet for Cash Register at countertop to align properly for cord drop to outlet below.
27. Cashier section to have standard non-locking drawer, no cash insert.
28. Deck mount single pantry fill faucet T&S Model no. B-0208.
29. Provide waterproof grommets in countertop for each piece of equipment mounted on counter top.
30. Manufacturers are to bid all items per specifications, deviations from the specified manufacturers or fabrication will not be accepted.

31. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.
32. Provision in counter for item 209 milk cooler, milk cooler is to be provided by 11 40 00.
33. Provide cut out and recessed receptacle in counter for two (2) each item 801 ice cream merchandiser. Provide S/S trim at Ice Cream units.
34. 6" stainless steel adjustable legs.
35. All conduit below counter to be supported from counter body.
36. Provide custom labels for all controls/dials.
37. All counter components to be powered from Load Centers.
38. **DO NOT** provide kickplate per Alvin ISD standard.
39. Counters to be factory installed, manufacturer to provide floor template and coordinate with mep and furr down requirements.
40. Manufacturers are to bid all items per specifications, deviations from the specified manufacturers or fabrication will not be accepted.
41. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.
42. CounterCraft delivery and assembly services. CounterCraft to deliver, uncrate, set in place, complete all field welds and joints, complete all final assembly, and level counters. Final utility (plumbing / electrical) connections not by CounterCraft.
43. **Special Instructions:** All floor sinks to be accessible. No under shelves at floor sink locations.

ITEM NO. 208 HEAT LAMPS

QUANTITY 2

Manufacturer:	Hatco
Model:	DL400 RTR
Size and Shape:	Refer to drawings
Alternate:	---

1. Ceiling mounted retractable heat lamps.
2. Heat lamp track adapter.
3. Verify color of track and fixture assembly with owner/architect.
4. Quantity Two (2) to include Two (2) heat lamps each.
5. Interconnect to wall mounted light switch by Division 26.
6. Locate per drawings.
7. Coordinate with overhead furr down and serving counter as required.
8. **Special Instruction:** Section 11 40 00 to coordinate with the General Contractor required wall blocking and electrical circuits to accept mounting of heat lamps.

ITEM NO. 209 DROP FRONT MILK COOLER - 8 CASE

QUANTITY 2

Manufacturer:	Mod-U-Serve
Model:	MCT-DM1
Size and Shape:	Refer to drawings
Alternate:	---

1. 18 gauge S/S fully welded liner.
2. 20 gauge S/S exterior.
3. Double pan insulated doors.
4. High pressure insulated foam.
5. 5" casters, two (2) with brakes.
6. ½" S/S nipple drain.
7. Locking mechanism.
8. Cord and plug. NEMA - 5-15P.
9. Corner bumpers.
10. 8 case capacity.
11. Strip curtains.
12. **Special Instruction:** Coordinate location of electrical receptacle so as to not interfere with location of milk dispenser.

ITEM NO. 212 MOBILE TRAY LOWERATOR

QUANTITY 2

Manufacturer:	Piper
Model:	ATCA-ST
Size and Shape:	Refer to drawings
Alternate:	Delfield, Caddy

1. Wrap around bumper.
2. Solid S/S bottom with finger grip.
3. Verified tray size with owner. Tray size 14' x 10'.
4. Four (4) casters, Two (2) with brakes.

ITEM NO. 214 CASH REGISTER

QUANTITY 2

Manufacturer:	Owner Furnished
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

ITEM NO. 249 THREE COMPARTMENT SINK

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings

Alternate: ---

1. Top: 14 gauge S/S 3" high 1-1/2" rolled rim at free sides, 10" high splash at walls.
2. Open base construction.
3. Omit rear rail at sink, and omit front rail at hose bibb.
4. Three (3) 30" x 26" x 15" deep sink compartments.
5. Two (2) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for ¾" hot and cold water connections.
6. Three (3) Fisher 22304 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. 12" deep single post mounted perforated overshelf mounted at 18" above counter top. Verify height with Owner. Stop shelf per drawing.
8. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Stop utensil rack per drawing.
9. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray rinse by owner.
10. 16 gauge S/S undershelf as per drawings.
11. Flanged feet at front only of counter.
12. Refer to section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**
13. **Special Instruction:** Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

ITEM NO. 250.1 CONVEYOR DISHMACHINE W. BUILT-IN BOOSTER

QUANTITY 1

Manufacturer:	Hobart
Model:	CL44-BAS
Size and Shape:	Refer to drawings
Alternate:	Champion

1. 44" Conveyor dishmachine with built-in water tempering kit and built-in booster heater.
2. Full display touchscreen control.
3. Prewired 15 KW Electric tank heat.
4. Booster Heater built-in 18KW.
5. Programmable, automatic dosing, pumped delime system.
6. Built-in Drain Water Tempering kit. Kit to be installed by Hobart Service.
7. Verify direction of dishmachine with drawings.
8. One (1) Year Extended warranty - One (1) Year parts and labor.
9. One (1) Year Extended warranty on booster heater - One (1) Year parts and labor.
10. Interior Chamber height to be 4" taller than standard.

11. Dual point electrical connection. One (1) connection for Motors, Controls and Tank Heat, and one (1) Connection for Internal Booster Heater. Div. 26 to provide S/S disconnect switches located as per plans interconnected to dishmachine and booster heater.
12. Unit comes with single point connection from factory. Div. 26 to use manufacturer provided wiring schematic to separate into a dual point connection, One (1) connection for the motors, controllers and tank heaters and One (1) connection for the boosters. Div. 26 to provide S/S disconnect switches located as per plans interconnected to dishmachine and booster heater.
13. Two (2) vent cowls with 4 x 16 vent and damper. Provide 18 gauge stainless steel seamless duct risers 6" above finish ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel flange with all corners welded.
14. One (1) table limit switch with stainless steel cover to conceal back. Provided by Manufacturer / Installed by Div. 26.
15. Four (4) 20"x20" Peg racks.
16. Four (4) 20" x 20" sheet pan racks.
17. Two (2) 20" x 20" combination racks.
18. Vent fan controls.
19. Peak Rate of drain flow = 38 gpm. Division 22 to provide and install backflow preventor between booster heater and filter. Final connection by Division 22. Coordinate location of electrical disconnects on free wall.

ITEM NO. 254 SOILED & CLEAN DISHTABLE

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S 3" high 1-1/2" rolled rim at free sides. 10" high splash at walls.
2. 14 gauge S/S recessed deposit shelf. Extend shelf through opening to be flush with wall at deposit side. Turn shelf down 2" at front with ¾" return at bottom (either scribed into partition or forming reveal). Shelf: integral with dishtable. Provide Component Hardware E32-4900 drain - extend drain line to floor sink.
3. Modify rolled rim at the operators side of the tray drop window to have a 3" recessed rolled rim.
4. Install Disposer as shown. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top and polished to match top for disposer control panel.
5. Provide One (1) T&S model no. B-0133-EE pre-rinse, B-0108-C spray head, two (2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
6. One (1) 18" disposer cone.
7. Provide ½" slope in top towards dishmachine per the general specifications.
8. One (1) Cookson Model #ESC-10 S/S roll down door at deposit shelf, when shown.
9. Fully welded s/s window frame, coordinate with roll down door.

10. S/S corner filler at backsplash; slope to dishtable.
11. S/S cover to conceal table limit switch.
12. Division 26 to install table limit switch, wiring to be concealed within counter fabrication.
13. 2 1/2" backsplash at dishmachine portion, single thickness of s/s will not be accepted.
14. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**
15. **Special Instruction:** Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor. All floor sinks to be accessible.

ITEM NO. 255 MOBILE DRYING RACK

QUANTITY 3

Manufacturer:	Metro
Model:	PR48VX3
Size and Shape:	Refer to drawings
Alternate:	Cambro Camshelving

1. Four (4) tier, includes two (2) drop-ins and (1) cutting board/tray drying rack, built in Microban antimicrobial product protection.
2. Two (2) no. 5MPX casters per unit.
3. Two (2) no. 5MPBX locking casters per unit.

ITEM NO. 601 HOT WATER DISPENSER

QUANTITY 1

Manufacturer:	Hatco
Model:	AWD-12
Size and Shape:	Refer to drawings
Alternate:	---

1. Water treatment system.
2. Cord and plug assembly, NEMA L6-30P.
3. Plumbing kit.
4. Stainless steel dormont water disconnect, sized to accommodate equipment. Run from filter to water connection.
5. Provide grommetted hole in countertop to accommodate utility requirements.
6. Provide wall mounting bracket / shelf.
7. G.C. to provide wall blocking.

ITEM NO. 615 MENU MONITOR SYSTEM

QUANTITY 2

Manufacturer:	Owner Furnished
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Owner to provide 42" monitors for installation by contractor.

2. Contractor to provide fully articulating ceiling or wall mounts.
3. GC to provide support in wall or above ceiling.
4. KEC to install.
5. If ceiling mounted, power and data connections to be terminated above the ceiling. If wall mounted, 1'-0" below the ceiling, flush mounted on the wall.

ITEM NO. 619 RECESSED GAS VALVE HOUSING

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. 18 gauge S/S.
2. S/S piano hinge door.
3. Sleeve connections - verify size and location.
4. Ansul gas valve to be mounted in housing prior to delivery to General Contractor.
5. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**
6. **Special Instructions:** Coordinate location with Division 22.

ITEM NO. 801 MOBILE ICE CREAM DISPENSER

QUANTITY 2

Manufacturer:	Master-Bilt
Model:	MSC-31AN
Size and Shape:	Refer to drawings
Alternate:	---

1. Curved tempered glass sliding lids.
2. Standard baskets.
3. Basket dividers.
4. Self contained refrigeration.
5. Coordinate with counter fabrication.
6. Unit to slide in to counter opening.

ITEM NO. 802 MOBILE WORKTABLE W/ UTENSIL CADDY

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Open base construction.
2. 16 gauge S/S overshelf post mounted 18" above working surface.
3. 16 gauge S/S undershelf.

4. Close back of splash when exposed.
5. Locking casters.
6. Provide One (1) Alegacy TC6S countertop Utensil caddy.
7. Countertop to be at 30" a.f.f.
8. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS**.

ITEM NO. 804 SPLASH GUARD

QUANTITY 3

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Provide 12 gauge stainless steel splash guards at each sink as required by health department.
2. Each guard is to be 12 gauge 304 stainless steel, 12” tall above top of sink x full depth of sink.
3. Front top edge to have 2” radius, back of splash to turn back 90 degrees for 3” and have three (3) “I” hooks for fastening to the wall.
4. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.**
5. **Special Instruction:** Coordinate mounting of guards with soap/towel dispensers and hand lavatories.

ITEM NO. 805 COUNTERTOP SNACK RACK

QUANTITY 2

Manufacturer:	BSI
Model:	BSI - CHIP RACK
Size and Shape:	Refer to drawings
Alternate:	---

1. Rack is portable to be set on countertop.
2. Custom portable shelving rack 2’6”x24”x15”.
3. Z-Guard 1” stainless steel post with #4 finish and portable feet.
4. 3 adjustable, custom shelves held to post with adjustable Z-Guard brackets

ITEM NO. 806 CEILING MOUNTED UT. RACK

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Ceiling mounted utensil rack, extend 1-5/8" diameter S/S post form cross rail, through top to 72" A.F.F. and weld full length x 2" x 1/4" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. 48" maximum upright post spacing. Mounting height to be 5'-4" a.f.f.. **Critical location** to be at center between two Item 167 worktables.

2. Provide (1) duplex receptacle mounted to pot rack at each end of table. Conceal electrical wiring within tubing. Interconnect and prewire a 5'-0" cord and plug out of receptacle housing for plugging into ceiling drop cord receptacle. 11 40 00 and Div. 26 to coordinate location of drop cord receptacle.
3. Refer to section 2.36 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS.

ITEM NO. 809B MOP & BROOM RACK

QUANTITY 3

Manufacturer:	ASI
Model:	1308
Size and Shape:	Refer to drawings
Alternate:	---

1. Provide model no. 1308-4 racks per drawing.
2. Capacity for four (4) mops / brooms.
3. G.C. to provide wall blocking.
4. Shelf with utility hooks and mop strip.
5. 15-year warranty.

ITEM NO. 812 REVERSE OSMOSIS WATER SYSTEM

QUANTITY 1

Manufacturer:	3M RO
Model:	5629101
Size and Shape:	Refer to drawings
Alternate:	---

1. Refer to Manufacturer's Engineering Drawing, Sheet K1.6 for all MEP coordination.
2. **K.E.C. and Plumbing Contractor to provide connection drawing submittal for Owner Review, prior to roughing in of utilities, to ensure tightest footprint possible for installation of RO equipment.**
3. **Provide to Item 803 Combi Oven.**
4. **RO Storage tank Model # 5598408 3M to verify tank size meets equipment requirements**
5. **11 40 00 and 3M to ensure RO water is blended for proper mineral content as per Item 172.1 Combi Oven specifications for water quality.**
6. All plumbing hoses, connections, fittings to be provided and installed by Division 22.
7. Div. 22 to provide all interconnection tubing and components required by RO system (Quick disconnect plumbing, cleaning bypass assembly, and connection fittings for standard 3⁄4" water line). Refer to Manufacturer's Data Sheet for mounting and connection instructions. Copper piping to the RO System by Div. 22. Plastic pipe or reinforced opaque beverage tubing from RO System to equipment by Div. 22.
8. **Special Instructions:** All floor sinks to be accessible.

ITEM NO. 813 WATER FILTER FOR ICE & RO SYS

QUANTITY 1

Manufacturer:	3M
Model:	5618907
Size and Shape:	Refer to drawings
Alternate:	---

1. Refer to Manufacturer's Engineering Drawing, Sheet K1.6 for all MEP coordination.
2. Interconnect to Item 109 Ice Maker and Item 812 Reverse Osmosis System.
3. CFS22 Housing # 5606704, Use CFS210 CTG # 5618907.
4. All plumbing hoses, connections, fittings to be provided and installed by Division 22.
5. **Special Instructions:** All floor sinks to be accessible.

ITEM NO. 901 S/S WALL PANEL

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Provide minimum 18 gauge stainless steel insulated wall panel. (non-insulated if walls are CMU) 5/8" pan formed, filled with USDA Approved insulation. Extend from top of coved base to underside of hood at full height wall / bottom of wall cap at half height wall. Top of panel to be secured to wall with 'Z' clips, bottom secured to wall with stainless steel oval head molly bolts.
2. Refer to Section 2.36 **PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS**

END OF SECTION 11 40 00

SECTION 11 52 13 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Front-projection screens.
2. Manual operation.
3. Electric operation.

B. Related Sections:
1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood backing for recessed screen installation.
2. Division 26 Sections for electrical wiring, connections, and installation of remote-control switches for electrically operated projection screens.

1.2 DEFINITIONS

A. Gain: Ratio of light reflected from or refracted by screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per FS GG-S-00172D(1).

B. Half-Gain Angle: The angle, measured from the axis of the screen surface, to the most central position on perpendicular plane through the horizontal centerline of the screen where the gain is half of the peak gain.

1.3 SUBMITTALS

A. Product Data: For each type of screen specified.

B. Shop Drawings: Show layout and types of projection screens. Include the following:
1. Location of screen centerline relative to ends of screen case.
2. Location of wiring connections.
3. Location of seams in viewing surfaces.
4. Connections to suspension systems for pendant- and recess-mounted screens.
5. Anchorage details.
6. Details of juncture of exposed surfaces with adjacent finishes.
7. Accessories.
8. Wiring Diagrams: For electrically operated units.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain projection screens through one source from a single manufacturer. Obtain each screen as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to begin.

PART 2 - PRODUCTS

2.1 FRONT-PROJECTION SCREENS

A. Material and Viewing Surface of Front-Projection Screens: Provide screens manufactured from mildew- and flame-resistant fabric of type indicated for each type of screen specified and complying with the following requirements:
   1. Matte-white viewing surface with gain characteristics complying with FS GG-S-00172D(1) for Type A screen surface.
   2. Material: Vinyl-coated glass-fiber fabric.
   3. Mildew Resistance: Provide mildew-resistant screen fabrics as determined by FS 191A/5760.
   4. Fire-Test-Response Characteristics: Provide projection-screen fabrics identical to materials that have been tested for flame resistance according to both small- and large-scale tests of NFPA 701.
   5. Seamless Construction: Provide screens in sizes indicated without seams.
   6. Edge Treatment: Black masking borders.
   7. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
      a. Color: Same as viewing surface.
      b. Location: At top of screen.
   8. Size of Viewing Surface: As indicated.

B. Electrically Operated Screens, General: Provide manufacturer's standard UL-labeled units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Remotely control operation of each screen to comply with the following:
   1. Single-Station Control: 3-position control switch with metal device box and cover plate for flush wall mounting and for connection to 120-V, ac power supply.
      a. Provide key-operated switch.
   2. End-Mounted Motor: Instant-reversing, gear-drive motor of size and capacity recommended by screen manufacturer with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Locate motor in its own compartment as follows:
      a. On right end of screen, unless otherwise indicated.
   3. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a diameter, metal rod with ends of rod protected by plastic caps.
      a. Roller for end-mounted motor supported by self-aligning bearings in brackets.
   4. Size(s): As indicated on the drawings.
   5. Electrically Operated Screens with Automatic Ceiling Closure: Units designed and fabricated for recessed installation in ceiling with bottom of case composed of 2 panels fully enclosing screen, motor, and wiring; 1 panel hinged and designed to open and close automatically when screen is lowered and fully raised, and the other panel removable or openable for access to interior of case; and complying with the following requirements:

a. Screen Case with End-Mounted Motor: Wood or medium-density-fiberboard sides and top with metal-lined motor compartment and aluminum or medium-density- fiberboard bottom panels, factory primed and constructed as follows:
b. Offset mount bottom panels so their bottom surface will align flush with adjoining ceiling and the bottom edges of case sides and ends will be recessed behind ceiling finish.
c. Provide single or double top as standard with manufacturer.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Matte-White Viewing Surfaces:
a. Matte White; Bretford Manufacturing, Inc. www.bretford.com
b. Matte White; Da-Lite Screen Co., Inc. www.da-lite.com
c. Fiberglass Matte White; Draper Shade & Screen Co., Inc. www.draperinc.com
2. Manually Operated Front-Projection Screens:
a. Series 500; Bretford Manufacturing, Inc. www.bretford.com
b. Model C; Da-Lite Screen Co., Inc. www.da-lite.com
c. Luma 2; Draper Shade & Screen Co., Inc. www.draperinc.com
d. Communicator; Stewart Filmscreen Corp. www.stewartfilm.com
3. Electrically Operated Screens with Automatic Ceiling Closure, End-Mounted Motor:
a. Advantage Deluxe Electrol; Da-Lite Screen Co., Inc., www.da-lite.com.
b. Ambassador; Draper Shade & Screen Co., Inc., www.draperinc.com

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and relationship to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
1. Manually operated units:
a. At installations with suspended acoustical panel ceilings at 9'-0" above finish floor. or less, suspend units from ceiling suspension system with manufacturer's standard scissor clips. Do not exceed carrying capacity of clips or ceiling suspension system.
b. At installations with suspended acoustical panel ceilings at greater than 9'-0" above finish floor, or with other ceiling types, suspend units from wall with manufacturer's wall brackets with standard or extended arm as required to clear adjacent wall-mounted fixtures or equipment.
2. Test electrically operated units to verify that screen, controls, limit switches, closure, and other operating components are in optimum functioning condition.
3. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

A. Protect projection screens after installation from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 11 61 43 - STAGE CURTAINS AND TRACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes the following types of stage curtains:
   1. Front-setting curtains including house curtain and valance.
   2. Rear curtain.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: Supplementary members supporting stage curtain systems to structure.

1.2 SUBMITTALS

A. Product Data: Include types, styles, materials, operating instructions, and maintenance recommendations.
   1. Setting Drawings, and templates for built-in or embedded anchor devices.

B. Shop Drawings: Include plans, elevations, and detail sections of typical track and rigging elements. Show anchors, hardware, operating equipment, and other components not included in manufacturer's Product Data. Include the following:
   1. Locations for blocking to be provided by others.
   2. Extent of required operating clearances.
   3. Calculations: Calculate requirements for supporting curtains, track, and equipment and verify capacity of each curtain, track, and rigging component to support loads.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available, together with 12-inch- square sample (any color) of each type fabric.

D. Samples for Verification: Not less than 36 inches square of each fabric from dye lot to be used for the Work, with specified treatments applied, and showing complete pattern repeat, if any. Mark top and face of fabric.

E. Product Certificates: Signed by manufacturers of stage curtains certifying that products furnished comply with requirements. Give name of flame-retardant chemical used, identification of applicator, treatment method, application date, allowable life span for treatment, and details of any restrictions and limitations.

F. 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.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of stage curtains similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: Provide stage curtains with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or a testing and inspecting agency acceptable to authorities having jurisdiction. Permanently attach label to each fabric of curtain assembly indicating that fabric is inherently and permanently flame resistant.
   1. Flame-Resistance Ratings: Passes NFPA 701.

1.4 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related

to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify stage curtain openings and 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. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening and construction dimensions and proceed with fabricating stage curtains without field measurements. Coordinate construction to ensure that actual opening and construction dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 CURTAIN FABRICS

A. General: Provide fabrics inherently and permanently flame resistant (IFR). Provide fabrics from the same dye lot.

B. Colors, Textures, and Patterns: Match Architect's samples.

C. Products: Subject to compliance with requirements, provide the following:
1. Woven Polyester Velour:
a. Prestige (IFR); KM Fabrics, Inc.
b. Plateau (IFR); KM Fabrics, Inc.

2.2 FRONT-SETTING CURTAIN FABRIC

A. Woven Polyester Velour: Napped fabric of 100 percent polyester; 54-inch minimum width; and other characteristics as follows:
1. K-M Prestige (IFR): Fabric weighing 26 oz./linear yard nominal, with pile height not less than 101 mils, with not less than 48 picks per inch; inherently and permanently flame resistant.

2.3 REAR SETTING CURTAIN FABRIC

A. Woven Polyester Velour: Napped fabric of 100 percent polyester; 54-inch minimum width; and other characteristics as follows:
1. K-M Plateau(IFR): Fabric weighing 13 oz./linear yard nominal, with pile height not less than 110 mils, with not less than 105 picks per inch; inherently and permanently flame resistant

2.4 METAL PRODUCTS

A. Steel Pipe: ASTM A 53, Grade A, standard weight (Schedule 40), black, 1-1/2-inch nominal diameter, unless otherwise indicated.

B. Galvanized Steel Sheet: Commercial-quality, zinc-coated, carbon-steel sheet; complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

C. Supports, Clamps, and Anchors: Sheet steel in manufacturer's standard thicknesses, galvanized after fabrication according to ASTM A 153/A 153M, Class B.

D. Trim and Support Cable: 1/4-inch- diameter, 7x19 galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written recommendations for size, number, and method of installation, including a drop-forged galvanized turnbuckle to allow for leveling.

E. Inserts, Bolts, Rivets, and Fasteners: Manufacturer's standard corrosion-resistant units.

2.5 CURTAIN FABRICATION

A. General: Affix permanent label, stating compliance with requirements of authorities having

jurisdiction, in accessible location on curtain not visible to audience. Provide vertical seams, unless otherwise indicated. Arrange vertical seams so they do not fall on faces of pleats. Do not use fabric cuts less than half width.

1. Vertical Hems: Provide vertical hems not less than 2 inches wide, with not less than a 1-inch tuck, and machine-sewn with no selvage material visible from front of curtain. Sew open ends of hems closed.
2. Leading Edge Turnbacks: Provide turnbacks formed by folding not less than 12 inches of face fabric back, with not less than a 1-inch tuck, and secured by sewing turnback vertically.
3. Top Hems: Reinforce top hems by double-stitching 3-1/2-inch-wide, heavy jute webbing to top edge with not less than 2 inches of face fabric turned under.
4. Pleats: Provide 50% added fullness in curtains, exclusive of turnbacks and hems, by sewing additional material into 6-inch double-stitched box pleats spaced at 12 inches o.c. along top hem reinforcement.
5. Grommets: Brass, centered on box pleats and 1 inch from corner of curtain, for snaps or S-hooks.
   a. Provide not less than No. 2 grommets except, for velour curtains, provide not less than No. 3 grommets.
6. Bottom Hems: For curtains that do not hang to the floor, provide hems not less than 3 inches deep with 3/4-inch weight tape. For floor-length curtains, provide hems not less than 6 inches deep with 1-inch weight tape. Sew open ends of hems closed.
7. Velour Curtains: Fabricate with the fabric nap down.

B. Curtain Battens: Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with a drive-fit pipe sleeve not less than 18 inches long and secure with four flush rivets, plug welds, threaded couplings, or another equally secure method. Shop-paint completed pipe battens with black paint with 1-inch-wide yellow stripe at the center of each batten.

C. Snap Hooks: Track manufacturer's heavy-duty hooks.

D. Tie Lines: Braided soft cotton, black or white to best match curtain; not less than 5/8-inch-wide by 36 inches long.

2.6 STRAIGHT CURTAIN TRACK FABRICATION

A. Steel-Track Channels: Fabricate of roll-formed galvanized steel sheet, with continuous bottom slot, and with each half of track in one continuous piece.
   1. Minimum Base-Metal Thickness: Not less than 0.0677 inch.

B. Heavy-Duty Track System: Equip track with heavy-duty, live-end, double-wheel pulley; heavy-duty, dead-end, single-wheel pulley; and adjustable, heavy-duty floor block; each with not less than 5-inch molded-nylon- or glass-filled-nylon-tired ball-bearing wheels, enclosed in steel housings. Provide single curtain carriers of molded nylon with a pair of neoprene-tired ball-bearing wheels riveted parallel to body. Provide one master carrier, for each leading curtain edge, of plated steel with two pairs of nylon-tired ball-bearing wheels and with two-line guides per carrier. Equip carriers with neoprene or rubber bumper to reduce noise, and heavy-duty, plated-steel swivel eye and manufacturer's standard trim chain for attaching curtain snap or S-hook. Provide end stops for track. Design adjustable floor block to maintain proper tension on operating line.
   1. Operating Line: Manufacturer's standard 3/8-inch stretch-resistant operating cord consisting of braided synthetic-fiber jacket over solid, synthetic-fiber, linear, center filaments.
   2. Track Lap Clamp: Metal to match track channel for attaching double-sectioned track at center overlap.
   3. Curtain Carriers: For track spaced at 12 inches o.c.
   4. Fold Guide: Equip carriers with rear-fold or backpack guide and rubber spacers to permit offstage curtain folding, sized for use with operating line, if any.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Silent Steel Model No. 281 with No. 2863, No. 2864, and No. 2866 pulleys; Automatic Devices Company. www.automaticdevices.com
2. Atlas Silk Model No. 418S; H & H Specialties, Inc. www.hhspecialties.com
3. Tru-Roll Model No. 1000; Tru-Roll, Inc. www.truroll.com

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage curtain work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Install stage curtain system according to track manufacturer's and curtain fabricator's written instructions.

3.4 BATTEN INSTALLATION

A. Install battens by suspending at heights indicated with steel cables spaced to support load, but do not exceed 10 feet o.c. between cables.

B. Secure cables either directly to structures or to inserts, eye screws, or other devices that are secure and appropriate to substrate and that will not deteriorate or fail with age or elevated temperatures. Attach other cable end to pipe clamps with turnbuckles, moused or fixed with nuts after adjustment, to prevent loosening.

3.5 TRACK INSTALLATION

A. Batten-Hung Tracks: Install track by suspending from pipe batten with manufacturer's track clamp hangers attached to batten pipe clamps at spacing, according to manufacturer's written instructions.
   1. Heavy-Duty Track: Do not exceed 72 inches between supports.

B. Install track for center-parting curtains with not less than 24-inch overlap of track sections at center, supported by special lap clamps.

3.6 CURTAIN INSTALLATION

A. Track Hung: Secure curtains to track carriers with track manufacturer's special heavy-duty S-hooks or snap hooks.

B. Batten Hung: Secure curtains to pipe battens with tie lines.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to test system and to train Owner's personnel to rig, adjust, operate, and maintain stage curtains, tracks, and draw-curtain machines.
   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 11 66 00 - ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: The following types of athletic equipment as shown on the Drawings:
   1. Protective wall padding.
   2. Exterior basketball goals.
   3. Volleyball floor inserts.

1.2 QUALITY ASSURANCE

A. For installation use only personnel who are skilled in the work required.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product data on physical characteristics and durability characteristics for each type of gymnasium equipment and accessory specified.

C. Installation Methods: Submit two copies of manufacturer's recommended installation method showing all requirements for blocking and bracing.

D. Shop drawings showing location and extent of athletic equipment and accessories. Include plans, elevations, large-scale details of anchorages, and accessory items. Indicate unit conditions at openings, typical and special details, and location and installation requirements for hardware and operators.

E. Template drawings prepared by manufacturer showing location of items supported or anchored by permanent construction.

1.4 PRODUCT HANDLING

A. Protection: Protect equipment before, during and after installation. Protect installed work of other trades.

B. Replacements: In event of damage, make necessary replacements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Unless otherwise indicated, provide Athletic Equipment by the following manufacturers:
   1. Aalco Manufacturing Co., www.aalcomfg.com
   2. ADP Lemco, Inc., www.adplemco.com
   3. Arizona Courtlines, www.arizonacourtlines.com
   4. Basketball Products International, www.basketballproductsinternational
   5. Douglas Industries, Inc., www.douglas-sports.com
   6. Gill Athletics, Inc., www.gillathletics.com
   7. Performance Sport Systems, www.perfsports.com
   8. Porter Equipment Co., www.porterathletic.com
   9. Sports Imports, www.sportsimports.com
   10. Substitutions: Section 01 60 00 - Product Requirements.

2.2 MATERIALS:

A. Protective Wall Padding:
   1. Basis-of-Design: Porter Equipment Co. wall wainscot padding No. 90350-326
   2. Provide protective wainscot wall padding, 2' x 6' x 1-1/2" thick 6 lbs density urethane foam

filled panels, covered with nylon reinforced vinyl fabric, fire retardant, color to be selected by Architect. Backing to be 7/16" thick plywood or OSB. Ends to be finished, no lip. Work to include special shaped column covers and cut outs for other trades.

3. Provide all related accessories required for installation. Mechanically anchor Wall Padding to walls concealing anchors. No lip shall be exposed beyond the edge of the padding. Use separate top pad, velcro attached to anchor strip to conceal anchors. Locate bottom of pads 8" above finish floor.

B. Exterior Basketball Goals:
   1. Manufacturer: Porter Equipment Company, www.porter-ath.com.
   2. Pole: #176; 5-9/16-inch diameter galvanized steel, 6-foot extension.
   3. Protective Pad: #00069- 000; 6 ft h., lace- on.
   4. Backboard: #00234-300; fan-shaped, cast aluminum, two-color powder coat finish.
   5. Goal: #00251-H00; 5/8-inch diameter solid rim with 3/16-inch support gussets, powder-coat finish, with chain net.
   6. Provide all related accessories required for installing, anchoring, and bracing equipment.

C. Volleyball Inserts:
   1. Basis-of-Design: Sports Imports *Model KA-25-S*, no substituitons.
   2. 3-inch I.D. steel sleeve with screw-down flange pre-drilled to receive cast brass, flush mounted floor plate with hinged access door.

PART 3 - EXECUTION

A. Inspection: Inspect installed work of other trades and verify that such work is complete to a point where this work may commence. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

B. Discrepancies: In event of discrepancy, notify Architect. Do not proceed with installation until discrepancies have been resolved.

C. Installation: Install where indicated, anchoring all components firmly in place in complete accordance with approved shop drawings and the manufacturer's recommendations.

END OF SECTION

SECTION 11 66 24 - BASKETBALL BACKSTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Indoor basketball backstops, backboards, goals and nets.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: Supplementary framing.
   2. Section 11 66 00 – Athletic Equipment: Exterior basketball goals.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.

B. National Federation of State High School Associations:
   1. NFHS - Basketball Rules Book.

C. Underwriters Laboratories Inc.:
   1. UL - Electrical Construction Equipment Directory.

1.3 SYSTEM DESCRIPTION

A. Indoor Backstops: Forward-folding, ceiling-mounted backstops with rectangular glass backboards at main court and wood backboards at cross courts.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
   1. Indicate size and location of backstops, mounting details, accessory anchoring members. Include wiring diagrams for electric operators and controls.

C. Product Data:
   1. Submit data indicating materials of construction, thicknesses, colors available.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include the following.
   1. Parts catalog with complete list of replacement parts.
   2. Schematic wiring diagrams of installed electrical equipment.

1.6 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL or another testing firm acceptable to authority having jurisdiction.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing work of this section with minimum three years’ experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept backstops on site in manufacturer's original packaging. Inspect for damage.

C. Store backstops indoors, protected from weather and contamination until installed.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish manufacturer's lifetime warranty for backstops and backboards.

PART 2 - PRODUCTS

2.1 BACKSTOPS

2.2 MANUFACTURERS:

A. Aalco Manufacturing www.aalcomfg.com
B. ADP Lemco, Inc., www.adplemco.com
C. Arizona Courtlines, www.arizonacourtlines.com
D. Draper, Inc. www.draperinc.com
E. Institutional Products, Inc. www.instprod.com
F. Performance Sports Inc. www.perfsports.com
G. Porter Athletic Equipment Company www.porter-ath.com
H. Spalding www.spaldingequipment.com
I. Substitutions: Section 01 60 00 - Product Requirements.

2.3 INDOOR BACKSTOPS

A. Center strut design, suspended from overhead building structural frame to support. Porter Model No. 312 or equal. Height adjustable, Electrical/Key operation.
   1. Tubular steel center post mast, approx. 6 in. dia., welded and bolted construction, designed to minimize sway and vibration during play; painted finish.
   2. Furnish manufacturer's standard hardware for backstop mounting.
   3. Furnish supplemental steel framing to span between building structural frame and support backstop at position indicated on Drawings.
   4. Steel framing factory painted in color as selected by the Architect.
   5. All switches for goal controls shall have a Sargent interchangeable core lock that is keyed to the gym entry key.
   6. Switches may not be ganged together.

B. Backboards: Fan Fiberglas Backboard with Backing plate.
   1. Basis-of-Design: Porter No, 00267-000.
   2. Install at sides of main court.

C. Goals: Steel, removable type; fabricated from 5/8-inch rod; 18 Inches inside clear diameter; with no-tie style net hooks; painted finish.
   1. Breakaway Goal: Single rim, rigid play up to 230 lbs, flexible for forces greater than 230 lbs.
      a. Basis-of-Design: Porter No. 00201-H00 Super-Flex Goal.

D. Net: Woven, size and style to fit goal; 15 to 18 inches long.
   1. Chord Net: Nylon.

2.4 WINCHES

A. Winch: Geared drive and cables designed to hold backstop at any position.
   1. Electric Winch: Motor and belt drive operated sized to suit application with adjustable upper and lower limit switches.

B. Motor: NEMA MG 1; 1/2 hp, 115 volts, single phase, 60 Hz; continuous duty rated.

C. Controls: Furnish individual three-position control switch for each goal.

1. Wall-mounted lockable control box furnished under another section.
2. Individual but ganged control switches for each basketball goal shall be located within this lock box and provided with a common cover plate.

2.5 ACCESSORIES

A. Safety Lock: Furnish Porter No. 797 Saf-Strap backstop safety lock at each folding backstop.

2.6 FABRICATION

A. Fabricate components in largest practical sizes for delivery.

B. Grind exposed welded joints flush and smooth with adjacent finish surface.

C. Provide fittings and hardware to accommodate site assembly and installation.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.7 SHOP FINISHING

A. Painted Metal Finishes:
1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
2. Do not paint surfaces in direct contact with concrete or where field welding is required.
3. Shop Painting:
a. Indoor Backstops: Manufacturer's standard enamel coating; black color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify walls are ready to receive backstops.

C. Verify electrical power is available with correct characteristics.

D. Verify finishing operations, including painting, are complete before installing backstops.

3.2 INSTALLATION

A. Install backstops in accordance with NFHS requirements.

B. Assemble components furnished loose for field assembly.

C. Install backboards plumb, level, and parallel to basketball court end line.

D. Install goals level and at elevation indicated.

E. Touch up damaged finishes to match shop finish.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust limit switches to prevent damage to equipment.

3.4 DEMONSTRATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate operation and maintenance of folding backstops.

END OF SECTION

SECTION 11 68 13 - PLAYGROUND EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes playground equipment.

B. Related Sections:
   1. Section 32 18 16 - Playground Protective Surfacing: Protective surfacing under and around playground equipment.

1.2 DEFINITIONS

A. Fall Height: According to ASTM F 1487, "the vertical distance between a designated play surface and the protective surfacing beneath it."

B. HDPE: High-density polyethylene.

C. IPEMA: International Play Equipment Manufacturers Association.

D. LLDPE: Linear low-density polyethylene.

E. MDPE: Medium-density polyethylene.

F. Use Zone: According to ASTM F 1487, the "area beneath and immediately adjacent to a play structure or equipment that is designated for unrestricted circulation around the equipment and on whose surface it is predicted that a user would land when falling from or exiting the equipment."

1.3 SUBMITTALS

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

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

C. Samples for Initial Selection: For each type of playground equipment and structure indicated.
   1. Manufacturer's color charts.
   2. Include similar Samples of playground equipment and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Posts and Rails: Not less than 6 inches long.
   2. Platforms: Not less than 6 inches square.
   3. Molded Plastic: Not less than 3 inches square.

E. Coordination Drawings: 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. Extent of surface systems and use zones for equipment.
   2. Critical heights for playground surfaces and fall heights for equipment.

F. Qualification Data: For qualified Installer.

G. Product Certificates: For each type of playground equipment, from manufacturer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of playground equipment.

I. Maintenance Data: For playground equipment and finishes to include in maintenance manuals.

J. Warranty: Manufacturer shall offer the following warranties on the materials and components of its system:

1. Lifetime limited warranty on support posts (uprights)
2. 15-year limited warranty on punched steel decks, pipes, rails, loops and rungs
3. 15-year limited warranty on rotationally molded polyethylene components
4. Lifetime limited warranty on all hardware

K. Manufacturer shall provide ISO 9001/2000 certification

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm whose playground equipment components have been certified by IPEMA's third-party product certification service.
   1. Provide playground equipment and play structure components bearing the IPEMA Certification Seal.

B. Catalog Standards: Manufacturer's model numbers may be shown in the Contract Documents for convenience in identifying playground equipment. Unless modified by notation in the Contract Documents, the model number description for the indicated model number constitutes requirements for that item of equipment.
   1. The use of model numbers, and the specific requirements set forth in the Contract Documents are not intended to preclude use of any other acceptable manufacturer's product which may be equivalent but are given for the purpose of establishing a minimum standard of design, function, and quality of materials, construction, and workmanship.
   2. All playground equipment components shall be furnished by a single manufacturer.

C. Installer Qualifications: An employer of workers approved by manufacturer.

D. Safety Standards: Provide playground equipment complying with or exceeding requirements in ASTM F 1487 and CPSC No. 325.

E. Preinstallation Conference: Conduct conference at Project site with owner and Architect prior to installation.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground equipment that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

A. Manufacturers: Basis-of-Design system is manufactured by **Play and Park Structures,** www.playandpark.com and installed by McKenna. Comparable products by non-specified manufacturers are acceptable when approved by the Owner and Architect.
   1. Equipment offered as a substitution to the equipment specified must be identical in basic design, function, and installation. Contractor shall be responsible for any related changes resulting from equipment manufactured by a non-specified company.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
   2. Cast Aluminum: ASTM B 179.

B. Steel: Comply with the following:
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M, hot-dip galvanized.
   2. Steel Pipe: ASTM A 53/A 53M or ASTM A 135/A 135M standard-weight, hot-dip galvanized.
   3. Steel Tubing: ASTM A 513, cold formed, hot-dip galvanized.
   4. Steel Sheet: ASTM A 1011/A 1011M, hot-dip galvanized not less than G60 coating designation.
   5. Perforated Metal: Steel sheet not less than 0.075-inch uncoated thickness; hot-dip galvanized; manufacturer's standard perforation pattern.

C. Opaque Plastic: Color impregnated, UV stabilized, and mold resistant.
   1. Polyethylene: Fabricated from virgin or recycled plastic resin; rotationally molded HDPE, LLDPE, or MDPE with not less than 1/4-inch wall thickness.

D. Post Caps: Cast aluminum or color-impregnated, UV-stabilized, mold-resistant polyethylene or polypropylene; color to match posts.

E. Platform Clamps and Hangers: Cast aluminum or zinc-plated steel, not less than 0.105 inch nominal thickness.

F. Hardware: Manufacturer's standard; commercial-quality; corrosion-resistant; hot-dip galvanized steel and iron, stainless steel, or aluminum; of a secure and vandal-resistant design.

G. Fasteners: Manufacturer's standard; corrosion-resistant; hot-dip galvanized or plated steel and iron, or stainless steel; permanently capped, and theft resistant.

2.3 PLAYGROUND EQUIPMENT FABRICATION

A. General: Provide sizes, strengths, thicknesses, wall thickness, and weights of components as indicated but not less than required to comply with structural performance and other requirements in ASTM F 1487. Factory drill components for field assembly. Unnecessary holes in components, not required for field assembly, are not permitted. Provide complete play structure, including supporting members and connections, means of access and egress, designated play surfaces, barriers, guardrails, handrails, handholds, and other components indicated or required to comply with referenced standards for equipment indicated.

B. Metal Frame: Fabricate main-frame upright support posts from metal pipe or tubing. Unless otherwise indicated, provide each pipe or tubing main-frame member with manufacturer's standard drainable bottom plate or support flange. Fabricate secondary frame members, bracing, and connections from either steel or aluminum.

C. Play Surfaces: Provide manufacturer's standard elevated drainable decks, platforms, landings, walkways, ramps, and similar transitional play surfaces, designed to withstand loads; fabricated from perforated or expanded metal made into floor units with slip-resistant foot surfaces. Fabricate units in manufacturer's standard modular sizes and shapes to form assembled play surfaces indicated.
   1. Elevated Play Surfaces: Provide protective devices, completely surrounding play surface except for access openings, if play-surface heights above protective surfacing exceed requirements in ASTM F 1487 and CPSC No. 325.
   2. Stepped Play Surfaces: Provide protective infill between stepped platforms.

D. Protective Barriers: Fabricated such that openings within the barrier and between the barrier and the play surface preclude passage of the torso probe according to the most stringent requirements in ASTM F 1487 and CPSC No. 325. Provide barriers designed to minimize the possibility of climbing, free of hand- and footholds, and configured to completely surround the protected area except for access openings. Extend barriers above the protected elevated

surface for use by age group indicated. Fabricate from the following:
1. Welded metal pipe or tubing with vertical bars.
2. Opaque plastic panels with openings.

E. Roofs and Canopies: Manufacturer's standard, designed to be positioned overhead and to discourage and minimize climbing by users.
1. Fabricated from opaque plastic.

F. Signs: Manufacturer's standard sign panels, fabricated from opaque plastic with graphics molded in, attached to upright support posts.

2.4 PLAYGROUND EQUIPMENT AND STRUCTURES

A. Frames: Galvanized-steel pipe or tubing frame sections connected with clamps.
1. Finish: Painted.
2. Color: As selected by Architect from manufacturer's full range.

B. Platforms: Perforated metal.
1. Finish: PVC coating.
2. Color: As selected by Architect from manufacturer's full range.

C. Roofs: Plastic.
1. Color: As selected by Architect from manufacturer's full range.

D. Components: As scheduled at end of this Section.

2.5 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: A minimum dry film thickness of 1.5 mils, medium gloss. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.6 IRON AND STEEL FINISHES

A. Galvanizing: Hot-dip galvanized products made from rolled-, pressed-, and forged-steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.
1. Hot-dip galvanized steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.
2. Galvanized-Steel Sheet: Commercial steel sheet, hot-dip galvanized, complying with ASTM A 653/A 653M for not less than G60 coating designation; mill phosphatized.

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 1.5 mils.

C. PVC Finish: Manufacturer's standard, UV-stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added, complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness of 80 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, site surface and subgrade drainage, and other conditions affecting performance of the Work.
1. Do not begin installation before final grading required for placing protective surfacing is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Verify locations of playground perimeter and pathways. Verify that playground layout and equipment locations comply with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Anchor playground equipment securely, positioned at locations and elevations indicated.
   1. Maximum Equipment Height: Coordinate installed heights of equipment and components with finished elevations of protective surfacing. Set equipment so fall heights and elevation requirements for age group use and accessibility are within required limits. Verify that playground equipment elevations comply with requirements for each type and component of equipment.

B. Post and Footing Excavation: Excavate holes for posts and footings as indicated in firm, undisturbed or compacted subgrade soil.

C. Post Set with Concrete Footing: Comply with ACI 301 for measuring, batching, mixing, transporting, forming, and placing concrete.
   1. Set equipment posts in concrete footing. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at the correct angle, alignment, height, and spacing.
      a. Place concrete around posts and vibrate or tamp for consolidation. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.
   2. Embedded Items: Use setting drawings and manufacturer's written instructions to ensure correct installation of anchorages for equipment.
   3. Concrete Footings: Smooth top, and shape to shed water.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections.
   1. Provide test and inspection reports to be included in close out documents.

B. Testing Agency: Owner may engage a qualified testing agency to perform additional tests and inspections.

C. Notify Architect 48 hours in advance of date and time of final inspection.

3.5 SCHEDULE - PLAY EQUIPMENT AND STRUCTURES

A. Arch Swing, Play and Park Structure No. 67558 (1) Bay

B. Arch Swing Add-A-Bay, Play and Park Structure No. 67620.(5) Bays

C. Adaptive Swing Package with Galvanized Chain, Play and Park Structure No. 67734.

D. Belt Seat Package 3-1/2" OD (11), Play and Park Structure No. 67597.

E. Playground Structure 5” Minimum Posts

F. Loop Arch Climber, Play and Park Structures No. 71111.

G. 8’ Trestle Bridge (2 Deck Span), Play and Park Structures No. 71437.

H. Incline Wall Climber, Play and Park Structures No. 71105.

I. Single Cascade, Play and Park Structures No. 71671

J. Hurricane Spiral Slide with Hood, Play and Park Structures No. 71394.

K. Fireman’s Pole, Play and Park Structures No. 71011.

L. Loop Pole Climber, Play and Park Structures No. 71049.

M. Return step, Play and Park Structures No. 61117.

N. Talk Tube, Play and Park Structures No. 71380.

O. Transfer Platform, Play and Park Structures No. 71006.

P. Single Velocity Wave Slide, Play and Park Structures No. 71659.

Q. "S" Horizontal Ladder, Play and Park Structures No. 71206.

R. (2) Vertical Ladders, Play and Park Structures No. 71145, 71381.

S. Swivel Station Link, Play and Park Structures No. 71253.

T. Log Roll, Play and Park Structures No. 71341.

U. Ball Toss with Numbers, 8', Play and Park Structures No. 67515.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Horizontal aluminum slat louver blinds and operating hardware.

B. Related Sections:
1. Section 08 11 13 - Standard Steel Doors and Frames: Steel window frames for mounting of louver blinds.
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts: Aluminum storefront frames for mounting of louver blinds.
3. Section 08 44 13 - Glazed Aluminum Curtain Walls: Aluminum curtain wall frames for mounting of louver blinds.
4. Section 12 24 13 – Roller Shades.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data: Submit product data indicating physical and dimensional characteristics, operating features, and available finishes.

C. Samples:
1. Submit two samples of louver slat, 12 inches long, illustrating materials and finish color.
2. Submit one full-size unit, not less than 16 inches wide by 24 inches long. Approved sample may be incorporated into the Work.

D. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:
1. Methods for maintaining horizontal louver blinds and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
3. Operating hardware.

1.3 QUALITY ASSURANCE

A. Obtain all horizontal louver blinds from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide horizontal louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Flame-Resistance Ratings: Passes NFPA 701.

C. Corded Window Covering Product Standard: Provide horizontal louver blinds complying with WCMA A 100.1.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related

to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.7 PROJECT CONDITIONS

A. Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds 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 operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hunter Douglas Window Fashions www.hunterdouglas.com
B. Levolor Contract; www.levolor.com
C. Springs Window Fashions Division, Inc.; www.springs.com
D. Substitutions: Section 01 60 00 - Product Requirements Not permitted.

2.2 COMPONENTS

A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

B. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
1. Width: 2-inch.
2. Thickness: 9-gauge minimum.
3. Color: As indicated on Drawings.

C. Slat Support: Woven polypropylene cord, ladder configuration.

D. Headrail: Pre-finished, formed steel or extruded aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
1. Color: Same as slats.

E. Bottom Rail: Pre-finished, formed steel or extruded aluminum tube, sealed with plastic or metal capped ends, with top side shaped to match slat curvature.
1. Color: Same as headrail.

F. Control Wand and Tilt Control: Consisting of enclosed, permanently lubricated worm gear mechanism and linkage rod, for the following operation:
1. Tilt Operation: Manual with non-removable clear plastic wand.
2. Length of Tilt Control: Length required to make operation convenient from floor level.
3. Tilt: Full.

G. Lift Cord: Braided polypropylene, with lock to stop blind at any position in ascending or descending travel.

H. Valance: Manufacturer's standard.
1. Finish Color Characteristics: Match color, texture, pattern, and gloss of louver slats.

I. Mounting: Method permitting easy removal and replacement without damaging blind or

adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment.

1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, installed where indicated.

2.3 FABRICATION

A. Comply with AWCMA Document 1029, unless otherwise indicated; each horizontal louver blind shall be self-leveling and consist of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.

B. Fabricate blinds to fit within openings as follows:

1. Blind units installed between (inside) jambs, or at openings requiring a single blind unit: Width equal to the jamb-to-jamb dimension of the opening, less 1/4 inch per side or 1/2 inch total.

2. Blind units installed outside jambs, or at openings requiring multiple blind units: Width and length as indicated, with terminations occurring 1/4” from centerlines of mullions.

3. Prior to issuing submittals, verify with Architect whether blinds should be located within the window frames or outside of the frames. Requirements may vary within the Project due to configurations of frames.

2.4 FINISH

A. Aluminum: For aluminum components exposed to view, apply manufacturer's standard baked enamel finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

B. Components: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive work.

C. Verify structural blocking and supports are correctly placed.

3.2 INSTALLATION

A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions. Install intermediate headrail support where required to prevent headrail deflection.

1. Control wands or cords for blinds at higher window sections shall not extend onto blinds of lower windows below.

2. Allow clearances between for window operating hardware, if any.

B. Secure in place with flush countersunk fasteners.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust blinds for smooth operation.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean blind surfaces just prior to occupancy.

END OF SECTION

SECTION 12 32 16 – MANUFACTURED PLASTIC LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes plastic laminate-clad cabinets and countertops. Related Sections:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Miscellaneous grounds and support framing.
   2. Section 06 20 23 - Interior Finish Carpentry and Millwork: For miscellaneous items of custom millwork not provided under this Section.
   3. Section 07 90 00 – Joint Protection: For requirements of sealant used at interface of casework and other materials.
   4. Section 08 80 00 - Glazing: Requirements for casework glazing.

1.2 REFERENCES

A. American Standards Testing Materials (ASTM):
   1. ASTM E84-09 – Standard Test Method for Surface Burning.

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. Federal Specification Unit:
   1. FS A-A-1936 - Adhesive, Contact, Neoprene Rubber.

D. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Submit data for each type of casework unit and hardware accessory.

D. Samples:
   1. Submit two samples, 6 x 6 inches in size, of each laminate finish.
   2. Submit one full size sample of a typical base cabinet unit, complete with doors, drawers, and hardware, but without countertop.
   3. Submit one full size sample of a typical wall cabinet unit, complete with doors, shelves, and hardware.
   4. Approved samples may be incorporated into the Work. If not incorporated into the Work, retain approved samples in building until completion of the Work and remove when directed by Architect.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with AWI (Architectural Woodwork Institute) Architectural Woodwork Quality Standards Illustrated, Custom Grade.

B. Single Source Responsibility: All casework, countertops, and accessories furnished under this Section shall be supplied by a single manufacturer.

C. Catalog Standards: Identification of casework units by manufacturer’s catalog numbers are intended to establish a basis-of-design for such units and are not intended to preclude the substitution of equivalent products by other manufacturers.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum three years' experience.

1.6 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect units from moisture damage.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. During and after installation of Work of this section, maintain same temperature and humidity conditions in building spaces as will occur after occupancy.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Provide manufacturer's written warranty against products provided under this Section becoming unserviceable or causing an objectionable appearance resulting from defects in materials and workmanship or installation. Defects shall include but not be limited to discoloration of finish, broken or loose parts, noisy or difficult operation of moving parts, and failure to meet specified requirements.

C. Warranty Period: 2-years from date of Project Substantial Completion.

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE-CLAD CASEWORK

A. Manufacturers:
1. A&M Casework, Inc.
2. Calmar Manufacturing Co. Inc.; Calmar, Iowa
3. Case Systems, Inc., www.casesystems.com
4. Global Casework Manufacturing, Inc., www.globalcasework.com.
5. Imperial Mill & Fixtures, Inc.
6. JC Millwork, Inc., www.jccompany.org.
7. Jericho Woodworks, www.schoolcasework.com.
8. Jim R. Reynolds & Associates, Inc., www.jimreynolds.com
9. MGC, Inc., www.mgcinc.net.
10. South Texas Woodmill, Inc.

11. Stephens Industries Inc., www.stevensind.com
12. Terrill Manufacturing, Company; San Angelo, Texas. www.terrillmfg.com
13. TMI Systems Design Corp.; Dickinson, ND www.tmisystems.com
14. Victoria Cabinet Works; Victoria, Texas
15. Westmark Commercial Case Work, Houston, Texas www.westmarkproducts.com
16. Substitutions: Section 01 25 13 - Product Substitutions.

B. Definitions: The following definitions apply to plastic laminate-clad casework:
   1. Exposed portions of casework (Finish Surfaces) include surfaces visible when doors and drawers are closed. Bottoms of cases more than 4'-0" above floor, tops of cases less than 6’-6” above floor, and visible members in open cases or behind glass doors shall be considered exposed.
   2. Semi-exposed portions of casework includes those members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors. Tops of cases 6'-6" or more above floor shall be considered semi-exposed.
   3. Concealed portions of casework include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

2.2 COMPONENTS

A. Lumber: AWI Custom Grade; maximum moisture content of 6-8 percent.

B. Plywood: AWI Grade B; veneer core; type of glue recommended for application.
   1. Furnish 7-ply veneer plywood for 3/4 inch thickness.
   2. Furnish 5-ply veneer plywood for 1/2 inch thickness.

C. High Pressure Decorative Laminate: NEMA LD 3, GP50 for horizontal surfaces, GP28 for vertical surfaces, CL20 for cabinet liner surfaces, BK20 for undecorated backing sheets; color, pattern, and surface texture as indicated. Wilson Art, Formica, Nevamar, or Pionite.

2.3 ACCESSORIES

A. Adhesive for High Pressure Decorative Laminates: FS A-A-1936 contact adhesive.

B. PVC Edge Trim: Extruded rigid PVC; smooth finish, of width to match component thickness; standard or custom color as required to match plastic laminate; 1 mm thickness at doors and drawers; 3 mm thickness at countertops.

C. Glass: Clear tempered double strength, as specified in Section 08 80 00.

D. Fasteners and Anchors:
   1. Fasteners: Hot dipped or Electro galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and Staples: ASTM F1667.

E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application.

F. Concealed Joint Fasteners: Threaded steel.

G. Grommets:

   1. Type: Plastic or nylon 2-1/2” diameter with flip-top tab in cap, in color(s) as selected by the Architect.

   2. Locations: Where indicated on the drawings and where needed for data wiring to pass through counter tops, whether or not indicated.

   3. Basis of Design: Model #EDP3 as manufactured by Doug Mocket & Co., 800-523-1269.

H. Hardware: Manufacturer's standard commercial-quality, heavy-duty hardware complying with requirements indicated, constructed with base materials and finishes as selected from manufacturer’s full range of standard materials and finishes.

1. Butt Hinges: Semi-concealed, 5-knuckle hinges complying with BHMA A156.9, Grade 1, constructed from minimum 0.095-inch tempered steel, with antifriction bearings and rounded tips. Provide minimum 170º door swing. Provide 2 hinges for doors less than 48 inches high and 3 hinges for doors 48 inches or more high.
2. Pulls: Solid metal, for drawers and swing doors, mounted with 2 screws fastened from back. For sliding doors, provide recessed flush pulls. Provide 2 pulls for drawers over 24" wide.
3. Door Catches: Dual self-aligning permanent magnet type. Provide 2 catches on doors over 4 ft. high.
4. Drawer Slides:
   a. Light and Medium Duty Drawers: Accuride 3832, KV 8400 or approved equivalent. Full extension all ball bearing 100 lbs. load rated with lever disconnect and positive outstop preventing inadvertent drawer removal.

      Or:

   b. 100-pound load rated epoxy powder coated steel, bottom corner mounted with smooth, quiet nylon rollers. Positive stop in both directions and self-closing feature.
5. File Drawer and Wide Heavy Duty Drawers:
   a. Accuride 4032, KV 8400 or approved equivalent. Full extension all ball bearing 150 lbs. load rated with rail mount, hold-in detent, progressive movement and positive outstop preventing inadvertent drawer removal.

      Or:

   b. 150 pound load rated epoxy powder coated steel, bottom corner mounted with smooth, quiet nylon rollers. Positive stop in both directions and self-closing feature.
6. Label Holders: Provide where indicated, size to receive standard label cards approximately 1” x 2” nominal size, finished to match other exposed hardware.
7. Drawer and Cupboard Locks: Half-mortise type, 5-pin tumbler and dead bolt, round cylinder only exposed, brass with plated finish.

   a. Key all locks in each room alike, with each room keyed differently.

   b. Lockable cabinets to receive cam lock on right door and metal finger spring release on interior of left door. (NO PULL CHAIN RELEASES).

   c. General Classroom casework shall not be keyed except for the Teacher Wardrobe and science classrooms. All other casework shall be keyed.

8. Sliding Door Hardware Sets: Manufacturer’s standard, to suit type and size of sliding door units.
9. Finish Base: Resilient base, type specified in Section 09 65 00. Provide on exposed sides, fronts, and backs of floor-mounted cabinets.
10. Adjustable Shelf Supports: BHMA B84073, wrought steel, mortise-mounted or Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on approximately 1.375 inch centers. Each shelf support to have two integral support pins, 5mm minimum diameter, to interface predrilled holes and to prevent rotation of support. Provide four supports per shelf. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports shall be designed so that they may be field fixed if desired. Structural load to 1200 pounds without failure (300 pounds per support).

2.4 FABRICATION

A. Fabricate casework in accordance with these specifications; approved shop drawings, samples and mock-ups; and project conditions. Verify field measurements prior to fabrication.

B. General Cabinet Requirements

1. Cabinet support bases shall be fabricated from solid lumber – all bases to be 2” x 4” pine.
2. Frames and structural parts of cabinets shall be fabricated from plywood or solid lumber.
3. Concealed back panels shall be fabricated from 1/2 inch thick plywood.
4. Shelves: No particle board or fiber board.
   a. Less than 30” long: 3/4-inch thick plywood.
   b. 30” to 36” long: 1-inch thick plywood.
   c. Over 36” long: 1-inch thick plywood with equally spaced vertical divider supports.
5. Drawer bodies including bottom shall be fabricated from 1/2 inch solid wood with 1/2” thick plywood bottom rabbeted-in.
6. Door and drawer faces shall be fabricated from 3/4-inch thick plywood core.
7. Drawers in Art & Science classrooms must have additional center support of drawer bottoms.
8. Wall cabinet and tall cabinet tops, bottoms, sides, divider panels, and exposed backs shall be fabricated from 3/4 inch thick plywood core.
9. Cabinet Toe Base: Solid lumber 4” high x 3” recess. Ready for finish rubber base installation.
10. All interior base cabinet corners and all filler pieces shall be closed at top and bottom of casework & millwork.

C. Laminate Cladding:
   1. Countertops and splashes: GP50.
   2. Exposed surfaces other than countertops and splashes: GP28.
   3. Semi-exposed surfaces: CL20.
   4. Concealed faces of exposed and semi-exposed surfaces: CL20 or BK20; all laminated construction shall be balanced and edge banded.
   5. P-lam on exposed sides of casework must extend over pine base several inches, so that 4” cove base adequately covers P-lam when casework is leveled into position.

D. Edge Banding:
   1. Countertops and splashes: PVC, 3mm.
   2. Doors, shelves, drawer fronts, and face frames of open shelving units: PVC, 3 mm.
   3. Face frames other than open shelving units, and tops and bottoms of drawers: PVC, 1-mm.

E. Countertop Construction:
   1. Size: Maximum practicable lengths.
   2. Thickness: 1-1/4 inch; provide front and end overhang of 1 inch over base cabinets.
   3. Rounded Corners: Provide min. 1 inch radius at all outside corners.
   4. Plastic Laminate: Shop-bond with waterproof adhesive to 1-1/8 inch thick plywood. OVERLAY PLYWOOD AND PARTICLEBOARD ARE UNACCEPTABLE. At countertops with sinks or other plumbed fixtures, use only marine grade plywood. Apply backing sheet to underside of countertop. Edge exposed edges of countertop and openings with same plastic laminate used for countertops.
   5. Splash: Construct splashes of 3/4 inch thick 7-ply plywood finished and edge banded with same plastic laminate used for countertops. Backsplashes shall be coved and clad with plastic laminate continuous with countertops.

F. Shop-assemble casework for delivery to site in units easily handled and to permit passage through building openings.

G. Door and Drawer Fronts: Flush overlay style.

H. Fit exposed edges with PVC edging. Use one piece for full length only.

I. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.

J. Apply high pressure decorative laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners Locate

counter butt joints minimum 2 feet from sink cut-outs.

K. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

L. Fabricate cabinets and counter tops with cutouts for plumbing fixtures, inserts, appliances, outlet boxes, and other fixtures and fittings. Verify locations of cutouts from on-site dimensions.

M. Shop glaze glass materials using Interior Dry method specified in Section 08 80 00.

N. All handicap sink knee spaces to have lift off gravity panels with “Z” style clips made of extruded aluminum. (NO SCREWS).

O. Uniform Rod & Shelving must have backing in wall and large screw anchors to ensure adequate resistance to the weight of Uniforms or Costumes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Set and secure casework in place; rigid, plumb, and level.

B. Use concealed joint fasteners to align and secure adjoining cabinet units, counter tops, and splashes.

C. Carefully scribe casework abutting walls and other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose. Apply color-matching sealant at interface of materials.

D. Base Cabinets:
1. Fasten each individual cabinet to floor at toe space, with fasteners spaced 24 inches o.c. Bolt continuous cabinets together. Secure individual cabinets with not less than 2 fasteners into floor, where they do not adjoin other cabinets.
2. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

E. Wall Cabinets:
1. Securely fasten to solid supporting material, not plaster, lath, or wallboard. Anchor, adjust, and align wall cabinets as specified for base cabinets.
2. Reinforcement of stud walls to support wall-mounted cabinets will be performed during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this Work.

F. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

G. Countertops:
1. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no job site processing of top and edge surfaces.
2. Fastenings: Use concealed clamping devices for field joints, located within 6 inches of front, at back edges and at intervals not exceeding 24-Inches. Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints.

Secure tops to cabinets with zee-type fasteners or equivalent, using 2 or more fasteners at each front, end, and back.

3. Workmanship: Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection. Provide flush hairline joints in top units using clamping devices.
4. After installation, carefully dress joints smooth, remove any surface scratches, clean and polish entire surface.
5. Provide holes and cutouts as required for mechanical and electrical service fixtures.
6. Provide scribe moldings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use permanently elastic sealing compound recommended by manufacturer.
7. Seal space between countertop backsplash and wall with sealant as specified in Section 07 90 00.

H. Accessories: Install in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting and balancing.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 12 56 51 – MANUFACTURED LIBRARY FURNITURE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Free-standing library furnishings.
   2. Circulation desk.

B. Related Sections:
   1. Section 06 10 53 – Interior Finish Carpentry and Millwork: For miscellaneous items of shop-fabricated millwork not included in this Section.
   2. Section 12 32 16 - Plastic Laminate-Clad Casework: For miscellaneous items of plastic laminate clad casework not included in this Section.
   3. Section 12 35 53 - Laboratory Casework.

1.2 SUBMITTALS:

A. Product Data: Submit manufacturer's product literature for each type of library furniture item and installation accessory required.
   1. Submit written data on physical characteristics, load bearing capabilities and durability.

B. Maintenance Data: Include data in Maintenance Manual as specified in Division-1.

C. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition of wood and painted metal surfaces under anticipated use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.

D. Shop Drawings: Submit installation drawings showing location extent of library furniture. Indicate location and extent of wiring for manufacturer provided electrical components.

E. Samples for Initial Selection Purposes: Submit manufacturer's standard size samples of library furniture finishes, but not less than 3" X 3", including wood and painted surfaces. Provide samples showing full range of colors, textures and patterns available for each type of component required.

F. Samples for Verification Purposes: Submit 12" square samples of each wood and paint finish required, prepared from same material to be used for the work.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firm (material producer) with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer's Qualifications: Firm specializing in furniture installation with not less than 2 years of experience in installation similar to those required for this project.

C. Single Source Responsibility: Provide material produced by a single manufacturer for all free-standing library furniture.

1.4 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.6 SEQUENCING AND SCHEDULING:

A. Sequence library furniture installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.7 WARRANTY:

A. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and the Manufacturer, agreeing to repair or replace units which fail in materials or workmanship within the specified warranty period.
   1. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
      a. Elevator System Warranty: Minimum 2-years after the date of Substantial Completion for the Project, including all parts and labor.
      b. Control Manufacturer's Warranty: Minimum 5-years after the date of Substantial Completion for the Project, including all parts and labor. Life of elevator system software updates.

1.8 MAINTENANCE:

A. Replacement Materials: Furnish accessory components as required. Furnish replacement materials from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

PART 2 - PRODUCTSE

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
   1. Bretford Manufacturing www.bretford.com
   2. Brodart Company www.brodart.com
   3. Buckstaff Company www.buckstaff.com
   4. Maco Manufacturing www.macomfg.com
   5. Oakwood Library Furniture, www.oakwoodlibrary.com
   6. Russwood Library Furniture, www.russwood.com
   7. TEC Educational Furniture, www.tecedfurniture.com
   8. Tesco Industries www.tesco-ind.com.
   9. Worden Co. www.wordencompany.com

2.2 MATERIALS:

A. Solid Wood: Select Red Oak, free from imperfections, thoroughly air seasoned, kiln dried.

B. Lumber Core Stock: Free from imperfections, thoroughly air seasoned stock, kiln-dried to moisture content of 5-7%, sealed top, bottom and exposed edges.

C. Plywood: Constructed with odd number of plies, all interior plies except core of center ply, occurring in pairs. Plies of each interior pair of same species, thickness and grain direction, placed on opposite sides of core. Grain direction of each ply at right angles to grain of adjacent plies, and edges of panels. All plies free of blisters, wrinkles, laps or other defects.

D. Particleboard Core Stock: Medium density, complying with ANSI A 208.1, 45 lbs./cu. ft. minimum average modulus of rupture of 2400 psi, minimum average modulus of elasticity of 400,000 psi.

E. High Pressure Laminate: 0.050" thick, backing sheet not less than 0.020" thick, complying with NEMA-LD3 Standard.

F. Glue: Water-resistant resin adhesive which retains strength when subjected to thorough wetting and drying.

G. Exposed Veneers: Plain-sliced, AWI standard A grade, uniform even grain.

2.3 MANUFACTURED UNITS:

A. Provide library furniture items with the following details, in sizes, quantities and configurations as scheduled.
1. Tops: Minimum 1" thick, 5-ply Veneer Core Plywood construction, with 1" x 3" solid hardwood banding, face veneer on exposed surface, plain veneer on underside.
2. End Panels and Back Panel: Same construction as worksurface top; height and width for sizes scheduled.
3. Box Drawers: 1/2" solid hardwood sides, dovetailed and glued. 1/4" five ply hardwood bottom, fitted into dado, glued and blocked into place. Equipped with full extension drawer glides and stops to prevent accidental removal.
4. Letter File Drawers: 1/2" solid hardwood sides, dovetailed and glued. 1/2" five ply hardwood bottom- fitted into dado, glued and blocked into place. Equipped with full extension file drawer slides, 150 lb. load capability.
5. Kickbase: 4" rubber base to match rubber wall base specified in Section 09 65 00 - Resilient Flooring.

2.4 FINISHES:

A. Wood Finishes: Provide library furniture with wood finish as specified.
1. Wood finish as selected by Architect from manufacturer's standard finishes.

B. Metal Finishes: Provide metal finish complying with ANSI A156.18, as scheduled
1. Chrome: Mirror Polished.
2. Bronze: Antique.
3. Brass: Polished.
4. Stainless Steel: Polished.

C. Plastic Laminate Finish: As selected by Architect from selected laminate manufacturer's full range of available color and finishes.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Verify that all library furniture components, including size and finish, are those specified before installing.

B. Verify that all required electrical hook-up provisions are in place prior to installing.

3.2 INSTALLATION:

A. Install furniture and accessories after finishing operations, including painting, have been completed.

B. Install furniture to comply with final layout drawings in strict compliance with manufacturer's printed instructions. Position units level, plumb; at proper location relative to adjoining units and related work. Adjust accessories to provide visually acceptable installation.

3.3 FIELD QUALITY CONTROL:

A. Remove and replace components which are chipped, scratched or otherwise damaged, or do not operate smoothly and which do not match adjoining work. Provide new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 CLEANING:

A. Immediately upon completion of furniture installation, clean components and surfaces.

B. Remove surplus materials, rubbish and debris resulting from installation, upon completion of work and leave areas of installation in neat clean condition.

3.5 PROTECTION:

A. Protect furniture against damage during remainder of construction period. Advise Owner of additional protection needed to ensure that furniture will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 12 93 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bicycle racks.

1.2 SUBMITTALS

A. Product data for each type of outdoor furnishings specified, with installation instructions for each unit built-in or connected to other construction. Include methods of installation for each type of substrate.

B. Shop drawings showing installation details of accessories permanently affixed to construction, including full scale installation details of special conditions.

C. Samples for initial selection purposes consisting of manufacturer's standard size samples showing full range of colors, textures, and patterns available for each type of accessory required.

D. Samples for verification purposes in full size units of each type of building accessory indicated.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than 3 years of production experience, who’s published literature clearly indicates general compliance of products with requirements of this section.

B. Single Source Responsibility: Provide material produced by a single manufacturer for each outdoor furnishing type.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity. Store materials laid flat and blocked off from the ground or slab to prevent sagging and warping.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.5 SEQUENCE AND SCHEDULING

A. Sequence outdoor furnishing installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.6 MAINTENANCE

A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and method which may be detrimental to finishes and performance.

B. Deliver extra materials to Owner. Furnish replacement materials described below from same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.
   1. For each item indicated, furnish quantity of units equal to 5 percent of amount

installed.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Bicycle Racks:
1. Formed steel pipe, nominal 2 inch diameter Sched.40, seamless, embedded in concrete footings at each end; capacity of 13 bikes; galvanized finish.
a. Furnish 1/2-inch diameter lock bar welded to each vertical member.
2. Basis-of-Design: Bike Security Racks Co., www.bikeracks.com, Model BS-12-AE.

2.2 FABRICATION

A. Provide accessory items, both free standing and permanently installed, equipped with functions as specified. Fabricate units with tight seams and joints, exposed metal edges rolled. Manufacturer or product identification on exposed surfaces is unacceptable. Provide products with smooth welds, consistent finish with no evidence of wrinkling, chipping, uneven coloration, dents, or other imperfections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify that materials are those specified before installing.

B. Install outdoor furnishings after other finishing operations, including painting, have been completed.

C. Site Furnishing Units: Install accessories complying with manufacturer's printed instruction, using fasteners as recommended by manufacturer as appropriate to substrate.

D. Adjust site furnishing items for proper operation. Clean and polish exposed surfaces, using materials and methods recommended by the manufacturer.

3.2 PROTECTION

A. Protect site furnishings against damage during remainder of construction period, complying with manufacturer's directions.

END OF SECTION

SECTION 14 24 00 - HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:
   1. Standard pre-engineered hydraulic passenger elevators.
   2. Elevator car enclosures, hoistway entrances and signal equipment.
   3. Operation and control systems.
   4. Jack(s).
   5. Accessibility provisions for physically disabled persons.
   6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
   7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
   1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
   2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
   3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
   4. Division 5 Metals:
      a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
      b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
   5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
   6. Division 16 Sections:
      a. Providing electrical service to elevators, including fused disconnect switches.
      b. Emergency power supply, transfer switch and auxiliary contacts.
      c. Heat and smoke sensing devices.
      d. Convenience outlets and illumination in control room, hoistway and pit.
   7. Division 22 Plumbing
      a. Sump pit and oil interceptor.
   8. Division 23 Heating, Ventilation and Air Conditioning
      a. Heating and ventilating hoistways and/or control room.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the Elevator’s proposal, since it is a part of the building construction.
   1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
   2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
   3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
   4. Elevator hoistways shall have barricades, as required.

5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. Machine room to be enclosed and protected.
10. Machine Room temperature must be maintained between 55º and 90º F.
11. If machine room is remote from the elevator hoistway, clear access must be available above the ceiling or metal/concrete raceways in floor for oil line and wiring duct from machine room.
12. Access to the machinery space and machine room must be in accordance with the governing authority or code.
13. Provide an 8” x 16” cutout through machine room wall, for oil line and wiring duct, coordinated with elevator contractor at the building site.
14. All wire and conduit should run remote from the hoistways.
15. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
16. Install and furnish finished flooring in elevator cab.
17. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
18. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
19. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
20. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
21. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
22. General Contractor shall fill and grout around entrances, as required.
23. Elevator sill supports shall be provided at each opening.
24. All walls and sill supports must be plumb where openings occur.
25. For applications with jack hole, free and clear access to the elevator pit area for the jack hole-drilling rig is required.
26. Where jack hole is required, remove all spoils from jack hole drilling.
27. When not provided by Elevator Contractor, jack hole shall accommodate the jack unit. If required the jack hole is to be provided in strict accordance with the elevator contractor's shop drawings.
28. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
29. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).

30. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch.
31. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.
32. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.
33. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..
34. Locate telephone and convenience outlet on control panel.

1.02 SUBMITTALS

A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
   1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
   2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
   3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
   4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat paint selection: Submit manufacturer’s standard selection charts for exposed finishes and materials.

D. Plastic laminate selection: Submit manufacturer’s standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:
   1. Owner’s manuals and wiring diagrams.
   2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
   1. The manufacturer of machines, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
   2. The manufacturer shall have a documented, on-going quality assurance program.

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
   1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
   2. Building Code: National.
   3. NFPA 70 National Electrical Code.
   4. NFPA 80 Fire Doors and Windows.
   5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
   6. Section 407 in ICC A117.1, when required by local authorities
   7. CAN/CSA C22.1 Canadian Electrical Code
   8. CAN/CSA B44 Safety Code for Elevators and Escalators.
   9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:
   1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   2. Arrange for inspections and make required tests.
   3. Deliver to the Owner upon completion and acceptance of elevator work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

B. Provide the hole for the jack unit (if required by the type of jack provided), based on excavation through normal soil or clay which can be removed by manual digging or by standard truck-mounted regular drilling unit. Provide a casing if required to retain the walls of the hole. General contractor shall remove excavation spoils deposited in the elevator pit.
   1. If a physical obstruction or hindrance is encountered below the ground surface, including boulders, rock, gravel, wood, metal, pilings, sand, water, quick sand, caves, public utilities or any other foreign material, obtain written authorization to proceed with excavating using special excavation equipment.
   2. Maintain a daily log of time and material costs involved.
   3. Elevator contractor will be compensated on a time and material basis for additional costs incurred after encountering the physical obstruction or hindrance, including the cost of the special excavation equipment.

1.06 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
   1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
   2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
   3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Design based around Fujitec hydraulic elevator *or approved equivalent per Substitution Request..*

2.02 MATERIALS, GENERAL

A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.

B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

C. Steel:
   1. Shapes and bars: Carbon.
   2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
   3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture’s standard selections.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture’s standard selections.

E. Flooring by others.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. Provide proper viscosity grade inherently biodegradable oil as specified by the manufacturer of the power unit (see Power Unit section 2.04.G for further details)

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:
   1. An oil reservoir with tank cover.
   2. An oil hydraulic pump.
   3. An electric motor.
   4. An oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and

quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
   1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
   2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
   3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
   4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
   5. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
   6. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
   1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
   2. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish with factory-applied powder coat finish entrance frame.
   3. Typical door & frame finish: ASTM A366 steel panels, factory applied powder coat enamel finish with factory-applied powder coat finish entrance frame.

B. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
   3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:
   1. Walls: Reinforced cold-rolled steel with two coats factory applied baked enamel finish, with applied vertical wood core panels covered with high pressure plastic laminate.
   2. Reveals and frieze: a. Reveals and frieze: Powder Coated
   3. Canopy: Cold-rolled steel with hinged exit.
   4. Ceiling: SS#4 with LED downlights.
   5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with brushed stainless steel
   6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
      a. Door Finish: Stainless steel panels: No. 4 brushed finish.
      b. Cab Sills: Extruded aluminum, mill finish.
   7. Handrail: Provide 1.5' diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, no. 4 brushed finish.
   8. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.
   9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
   1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
   2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
   3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered

before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.

4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED’s shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

D. Special Equipment: Key switch

2.09 CONTROL SYSTEMS (Smartrise Controls Only) No alternates will be accepted

A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

2.10 HALL STATIONS

A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.
   1. Provide one pushbutton riser with faceplates and pushbuttons having a brushed stainless steel finish and buttons should be vandal resistant.
      a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable

D. Hall lanterns: Not Applicable

E. Special Equipment: Key switch operation in each hall station for hall call lock-out to match owners master keying system. Cylinder cores provided under the Hardware Section.
   1. Provide switch accepting removable cylinder keyed to Owner's master keying requirements. Removable cylinder provided under the Hardware Section.

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Jack unit excavation (if required by the type of jack provided): Drill or otherwise excavate below elevator pit construction as required to install the jack unit.
   1. Install casing for jack unit.
   2. Provide HDPE jack protection system for all in ground jacks.
   3. Set casing for jack unit assembly plumb, and partially fill with water set¬tled sand, eliminating voids. Back fill depth shall be sufficient to hold the bottom of the jack in place over time.

C. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

D. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

E. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

F. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

G. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

I. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

J. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
   1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1
   1. Elevator Model: Fujitec Hydraulic Elevator
   2. Elevator Type: Hydraulic Passenger Elevator
   3. Rated Capacity: 3500 lbs.
   4. Rated Speed: 100 ft./min.
   5. Operation System: Smartrise Controls
   6. Travel: 14'-8"
   7. Landings: 2 total
   8. Openings:
      a. Front: 2

   b. Rear: 0
9. Platform size: 7'' wide x 6'-3" deep
10. Inside clear height: 7'-4" standard
11. Door clear height: 7'-0" standard
12. Hoistway Entrance Size: 3'-6" wide x 7'-0" high
13. Door Type: One-speed | LH Side opening
14. Power Characteristics: 208 volts, 3 Phase, 60 Hz.
15. Seismic Requirements: Zone 1
16. Hoistway Dimensions: 8'-8'' wide x 7'-0" deep
17. Pit Depth: 4'-0"
18. Button & Fixture Style: Vandal resistant SS#4
19. Special Operations: Limited Access key switch

END OF SECTION

Project Manual

August 18, 2025
STANTEC Project No. 21400 1269

Elementary School No. 23

Alvin Independent School District
Manvel, Texas

Final Construction Documents

VOL. 2 of 2

All required permits must be obtained before construction

rear cover

SECTION 00 01 01 - TITLE PAGE:

TITLE AND LOCATION OF THE WORK:

ELEMENTARY SCHOOL #23
2727 White Gold Drive
Rosharon, Texas 77583

NAME AND ADDRESS OF THE OWNER:

ALVIN INDEPENDENT SCHOOL DISTRICT
301 East House Street
Alvin, Texas 77511

NAME AND ADDRESS OF THE ARCHITECT and CONSULTANTS:

STANTEC
ARCHITECT
910 Louisiana Street, Suite 2600
Houston, Texas 77002
Ph (713) 548-5700

S&G Engineers
CIVIL ENGINEER
1796 Avenue D, Suite B
Katy, Texas 77493
Ph (832) 437-7377

CMTA ENGINEERING CONSULTANTS
MEP, TECHNOLOGY & FIRE PROTECTION
2201 Timberloch Place
The Woodlands, Texas 77380
Ph (281) 419-9899

PEA Group
LANDSCAPE ARCHITECT
16060 Dillard Drive, Suite 250.
Houston, Texas 77040
Ph (713) 688-3530

STANTEC
STRUCTURAL ENGINEER
910 Louisiana Street, Suite 2600
Houston, Texas 77002
Ph (713) 548-5700

FOODSERVICE DESIGN PROFESSIONALS
FOOD SERVICE CONSULTANT
594 Sawdust Road, Suite 139
The Woodlands, Texas 77380
Ph (281) 350-2323

TITLE OF DOCUMENTS BOUND HEREWITH:

TITLE PAGE
INDEX TO SPECIFICATIONS
CONTRACT DOCUMENTS

DOCUMENT 00 01 10 – MASTER TABLE OF CONTENTS

Note: This Master Table of Contents includes **all** specification sections for the Project regardless of origin. Sections marked by asterisk (*****) below are provided by consultants to the Architect or Owner and are not covered by the Architect's seal. Refer to attached supporting Tables of Contents to identify Consultant responsible for a particular section.

VOLUME 1 of 2

Section	Title
00 01 01	Project Title Page
00 01 10	Master Table of Contents
*00 01 11	Sealed Structural Table of Contents
*00 01 12	Sealed MEP Table of Contents
*00 01 13	Sealed Civil Table of Contents
*00 01 14	Sealed Landscape Table of Contents
00 01 15	List of Drawings – Reference Drawing Sheet **G002**

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS - for Competitive Sealed Proposals (CSP)

*00 01 16	Invitation to Proposers
*00 22 13	Supplementary Instructions to Proposers and Attached Forms
*00 23 13	Ranking Criteria for Competitive Sealed Proposals (CSP)
*00 31 32	Geotechnical Data
00 41 00	Proposal Form (Base & Unit Prices)
00 41 10	Proposal Form (Alternates Proposals)
00 43 13	Proposal Security
00 50 00	Construction Contract and Conditions
00 60 00	Bonds and Certificates
*00 73 00	Supplementary Conditions
*00 73 43	Wage Rates

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	Summary of Work and Scheduling
01 21 00	Cost Allowances
01 22 00	Unit Prices
01 23 00	Alternates
01 25 13	Product Substitutions
01 26 00	Contract Modification Procedures
01 29 00	Applications for Payment
01 30 00	Administrative Requirements
01 30 10	Mechanical and Electrical Coordination
01 31 19	Project Meetings
01 32 00	Notification of Architect Requirements
*01 32 23	Survey and Layout Data
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 42 19	Reference Standards and Definitions
01 50 00	Temporary Facilities
*01 55 13.10	Stabilized Construction Access
*01 55 26	Traffic Control
*01 57 10	TPDES Requirements
*01 57 19	Temporary Environmental Controls
*01 57 23	Temporary Storm Water Pollution Control
01 60 00	Product Requirements
01 70 00	Execution and Closeout Procedures

01 73 29 Cutting and Patching
*01 74 16 Site Maintenance
*01 74 19 Construction Waste Management and Disposal
01 78 00 Warranties
*01 80 00 Special Owner Requirements
*01 91 13 General Commissioning Requirements
*01 91 14 Commissioning Authority Responsibilities

DIVISION 02 – EXISTING CONDITIONS
*02 41 13.10 Removing Existing Pavement and Structures

DIVISION 03 - CONCRETE
*03 30 00 Cast-In-Place Concrete
03 35 43 Special Concrete Floor Finishes
03 52 16 Insulating Concrete Roof Fill
*03 62 00 Non-Shrink Grout

DIVISION 04 - MASONRY
04 05 03 Masonry Mortaring and Grouting
04 20 00 Unit Masonry Assemblies
*04 29 00 Engineered Unit Masonry

DIVISION 05 - METALS
*05 12 00 Structural Steel Framing
*05 12 13 Architecturally Exposed Structural Steel
*05 21 00 Steel Joist Framing
*05 31 00 Steel Decking
*05 40 00 Cold-Formed Metal Framing
05 50 00 Metal Fabrications
05 51 00 Metal Stairs
05 52 00 Metal Railings

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES
06 10 53 Miscellaneous Rough Carpentry
06 20 24 Interior Finish Carpentry and Millwork
06 42 19 Plastic Laminate Wall Panels
06 61 16 Solid Surfacing Fabrications
06 61 19 Quartz Surfacing Fabrications

DIVISION 07 - THERMAL AND MOISTURE PROTECTION
07 13 00 Sheet Waterproofing
07 19 16 Concrete Floor Sealer and Finish
07 21 13 Thermal Wall Insulation
07 27 26 Fluid Applied Membrane Air Barrier
07 42 13 Metal Soffit Panels
07 54 23 Multiply PVC Kee Fleeceback Membrane Roofing
07 62 00 Sheet Metal Flashing and Trim
07 71 00 Roof Specialties
07 72 33 Roof Hatches
07 81 00 Applied Fireproofing
07 84 00 Firestopping
07 90 00 Joint Protection
07 95 00 Premanufactured Expansion Joint Systems

DIVISION 08 - OPENINGS

08 11 13	Standard Steel Doors and Frames
08 14 16	Flush Wood Doors
08 31 13	Access Doors and Frames
08 32 13	Sliding Aluminum-Framed Glass Doors
08 33 13	Overhead Counter Doors
08 33 23	Overhead Coiling Doors
08 34 73	Sound Control Door Assemblies
08 41 13	Aluminum-Framed Entrances and Storefronts
08 44 13	Glazed Aluminum Curtain Walls
08 45 00	Translucent Wall and Roof Assemblies
08 56 54	Ballistic Rated Transaction Windows
*08 71 00	Door Hardware
*08 74 00	Access Control Monitoring System
08 80 00	Interior Glazing
08 88 56	Ballistic and Impact-Resistant Glazing
08 91 00	Louvers

DIVISION 09 - FINISHES

09 21 16	Gypsum Board Assemblies
09 30 00	Tiling
09 51 13	Lay-In Acoustical Panel Ceilings
09 54 23	Linear Metal Ceiling System
09 64 13	Finish Wood Stage Steps
09 65 00	Resilient Flooring and Base
09 65 66	Resilient Athletic Flooring
09 66 23	Resinous Matrix Terrazzo Flooring – Alternate
09 68 16	Carpeting
09 72 00	Wall Coverings
09 72 16.16	Rigid Sheet Vinyl Wall Protection
09 77 00	FRP Wall Panels
09 77 23	Fabric Wrapped Wall Panels
09 90 00	Painting and Coating
09 96 53	Elastomeric Coatings

DIVISION 10 - SPECIALTIES

10 11 00	Visual Display Surfaces
10 14 00	Graphics Panels, Plaques, and Building Letters
10 14 26	Post and Panel Signs
10 21 15	Solid Plastic Toilet Compartments
10 26 41	Ballistic-Resistant Fiberglass Panels
10 28 00	Toilet Accessories
10 28 10	Miscellaneous Specialties
10 44 00	Fire Protection Specialties
10 51 13	Metal Wardrobe Lockers
10 73 26	Aluminum Walkway Covers and Canopies
10 75 00	Flags and Flagpoles

DIVISION 11 - EQUIPMENT

*11 40 00	Food Service Equipment
11 52 13	Projection Screens
11 61 43	Stage Curtains and Tracks
11 66 00	Athletic Equipment
11 66 24	Basketball Backstops
11 68 13	Playground Equipment and Structures

DIVISION 12 - FURNISHINGS
12 21 13 Horizontal Louver Blinds
12 32 16 Manufactured Plastic Laminate-Clad Casework
12 56 51 Manufactured Library Furniture
12 93 00 Site Furnishings

DIVISION 13 – NOT USED

DIVISION 14 – CONVEYING EQUIPMENT
14 24 01 Hydraulic Passenger Elevators

DIVISIONS 15 Through 20: Not Used

End of Master TOC Volume 1

VOLUME 2 of 2

Section	Title
00 01 01	Project Title Page
00 01 10	Master Table of Contents
*00 01 11	Sealed Structural Table of Contents
*00 01 12	Sealed MEP Table of Contents
*00 01 13	Sealed Civil Table of Contents
*00 01 14	Sealed Landscape Table of Contents

DIVISION 21 - FIRE SUPPRESSION

*21 01 00	Fire Protection General Requirements
*21 01 20	Fire Protection Shop Drawings and Submittals
*21 01 50	Fire Protection Materials and Methods
*21 05 53	Identification for Fire Suppression Piping and Equipment
*21 13 00	Fire Suppression Sprinkler Systems

DIVISION 22 - PLUMBING

*22 01 00	Plumbing General Requirements
*22 01 20	Plumbing Shop Drawings and Submittals
*22 01 50	Plumbing and Piping Materials and Methods
*22 05 29	Hangers and Supports for Plumbing Piping and Equipment
*22 05 53	Identification for Plumbing Piping and Equipment
*22 07 19	Plumbing Piping Insulation
*22 08 00	Commissioning of Plumbing
*22 10 05	Plumbing Piping
*22 10 06	Plumbing Piping Specialties
*22 13 23	Sanitary Waste Interceptors
*22 30 00	Plumbing Equipment
*22 40 00	Plumbing Fixtures

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

*23 01 00	Mechanical General Requirements
*23 01 20	Mechanical Shop Drawings and Submittals
*23 01 50	Mechanical Materials and Methods
*23 05 13	Common Motor Requirements for HVAC Equipment
*23 05 19	Meters and Gauges for HVAC Piping
*23 05 23	General Duty Valves for HVAC Piping
*23 05 29	Hangers and Supports for HVAC Piping and Equipment
*23 05 53	Identification for HVAC Piping and Equipment
*23 05 93	Testing, Adjusting, and Balancing for HVAC
*23 07 13	Duct Insulation
*23 07 16	HVAC Equipment Insulation
*23 07 19	HVAC Piping Insulation
*23 08 00	Commissioning of HVAC
*23 09 00	Instrumentation and Control for HVAC
*23 09 30	Kitchen Hood Ventilation Control System
*23 09 34	Variable Frequency Motor Controllers for HVAC
*23 09 93	Sequence of Operations for HVAC Controls
*23 21 13	Hydronic Piping

*23 21 14 Hydronic Specialties
*23 21 23 Hydronic Pumps
*23 23 00 Refrigerant Piping
*23 25 00 HVAC Water Treatment
*23 31 00 HVAC Ducts and Casings
*23 33 00 Air Duct Accessories
*23 34 23 HVAC Power Ventilators
*23 34 39 High Volume Low Speed Propeller Fans
*23 36 00 Air Terminal Units
*23 38 13 Commercial Kitchen Hoods
*23 38 13.01 Residential Kitchen Range Hood for Commercial Buildings
*23 51 00 Breechings, Chimneys, and Stacks
*23 52 16 Condensing Boilers
*23 64 23 Scroll Water Chillers
*23 73 13 Modular Indoor Central Station Air Handling Units

DIVISION 26 - ELECTRICAL
*26 01 00 Electrical General Requirements
*26 01 20 Electrical Shop Drawings and Submittals
*26 05 19 Low Voltage Electrical Power Conductors and CAbles
*26 05 26 Grounding and Bonding for Electrical Systems
*26 05 29 Hangers and Supports for Electrical Systems
*26 05 33.13 Conduit for Electrical Systems
*26 05 33.16 Boxes for Electrical Systems
*26 05 33.23 Surface Raceways for Electrical Systems
*26 05 36 Cable Trays for Electrical Systems
*26 05 53 Identification for Electrical Systems
*26 05 73 Power System Studies
*26 08 00 Commissioning of Electrical
*26 09 23 Lighting Control Devices
*26 21 00 Low Voltage Electrical Service Entrance
*26 22 00 Low Voltage Transformers
*26 24 13 Switchboards
*26 24 16 Panelboards
*26 27 26 Wiring Devices
*26 28 13 Fuses
*26 28 16.13 Enclosed Circuit Breakers
*26 28 16.16 Enclosed Switches
*26 29 13 Enclosed Controllers
*26 32 13 Engine Generators
*26 36 00 Transfer Switches
*26 36 33 Generator Docking Station
*26 43 13 Surge Protective Devices
*26 51 00 Interior Lighting
*26 56 00 Exterior Lighting

DIVISION 27 - COMMUNICATION
*27 00 00 Common Communications Requirements
*27 05 03 Communications Shop Drawings and Submittals
*27 05 10 Scope of the Communications Work
*27 05 29 Hangers and Supports for Communications Systems
*27 10 00 Structured Cabling Common Requirements
*27 11 00 Communications Equipment Room Fittings
*27 11 16 Communications Racks, Frames, and Enclosures

*27 13 23 Communications Optical Fiber Backbone Cabling
*27 15 13 Communications Copper Horizontal Cabling
*27 30 14 Voice Communication System for Elevators
*27 41 16 Integrated Audo Video Systems and Equipment – Common Requirements
*27 41 16.55 Integrated Audo Video Systems - Dining
*27 41 16.56 Integrated Audo Video Systems - Gymnasium
*27 41 23 Integrated Audo Cabling and Accessories
*27 51 23 Intercommunications and Program Systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
*28 00 00 Common Electronic Safety and Security Requirements
*28 05 03 Electronic Safety and Security Shop Drawings and Submittals
*28 05 10 Scope of the Electronic Safety and Security Work
*28 10 00 Access Control
*28 31 11 Intrusion Detection System
*28 46 00 Fire Detection and Alarm

DIVISIONS 29 & 30 – Not Used

DIVISION 31 - EARTHWORK
*31 00 00 Site Earthwork
*31 06 20.15 Cement Stabilized Sand
*31 06 20.17 Utility Backfill Materials
*31 11 00 Clearing and Grubbing
*31 22 00 Site Grading
*31 22 16 Fine Grading
*31 22 17 Topsoil
*31 23 15 Building Earthwork
*31 23 16.14 Trench Safety System
*31 23 33 Excavation and Backfill for Utilities
31 31 16 Termite Control
*31 63 29 Drilled Concrete Piers and Shafts

DIVISION 32 - EXTERIOR IMPROVEMENTS
*32 01 90 Operation and Maintenance of Planting
*32 11 13.13 Lime-Treated Subgrades
*32 11 29.13 Lime-Fly Ash-Treated Base Courses
*32 13 13.00 Concrete Paving
*32 13 13.13 Concrete Pavement Curing
*32 13 13.25 Concrete Sidewalks
32 13 17 Integrally Colored Decorative Concrete Paving
*32 13 73 Concrete Paving Joints and Sealants
*32 16 13 Curbs and Gutters
*32 17 23 Pavement Markings
32 18 16 Playground Protective Surfacing
32 31 13 Chain Link Fences and Gates
32 31 19 Decorative Metal Fences and Gates
32 31 25 Louvered Fencing and Gates
*32 84 00 Planting Irrigation
*32 91 13 Soil Preparation
*32 91 14 Planting Media
*32 92 00 Turf and Grasses
*32 92 13 Hydromulch Seeding
*32 93 00 Plants

DIVISION 33 – UTILITIES

*33 05 13 Manholes and Structures
*33 05 13.13 Manhole Grade Adjustment
*33 05 16.13 Precast Concrete Utility Structures
*33 05 16.16 Concrete for Utility Construction
*33 06 10.14 Polyvinyl Chloride (PVC) Pipe
*33 06 10.15 Ductile Iron Pipe and Fittings
*33 06 40.10 HDPE Solid and Profile Wall Pipe
*33 06 40.11 Reinforced Concrete Pipe
*33 11 00 Water Utility Distribution Piping
*33 12 13.10 Tapping Sleeves and Valves
*33 12 13.12 Wet Connections
*33 12 16 Water Utility Distribution Valves
*33 12 19 Water Utility Distribution Fire Hydrants
*33 12 40 Valve Boxes, Meter Boxes, and Meter Vaults
*33 13 00 Disinfecting of Water Utility Distribution
*33 13 00.10 Hydrostatic Testing of Pipelines
*33 31 00 Sanitary Utility Sewerage Piping
*33 31 00.10 Acceptance Testing for Sanitary Sewers
*33 41 00 Storm Utility Drainage Piping
*33 49 13 Storm Drainage Manholes, Frames, and Covers

End of Master TOC Volume 2

DOCUMENT 00 01 11 – STRUCTURAL TABLE OF CONTENTS

DIVISION 03 – CONCRETE
03 30 00 Cast-In-Place Concrete
03 62 00 Non-Shrink Grout

DIVISION 04 - MASONRY
04 29 00 Engineered Unit Masonry

DIVISION 05 - METALS
05 12 00 Structural Steel Framing
05 12 13 Architecturally Exposed Structural Steel
05 21 00 Steel Joist Framing
05 31 00 Steel Decking
05 40 00 Cold-Formed Metal Framing

DIVISION 31 – EARTHWORK
31 23 15 Building Earthwork
31 63 29 Drilled Concrete Piers and Shafts

2025.08.18

MEP TABLE OF CONTENTS

DIVISION 01 - GENERAL
01 91 13 General Commissioning Requirements
01 91 14 Commissioning Authority Responsibilities

DIVISION 21 - FIRE SUPPRESSION
21 00 00 Fire Protection General Requirements
21 01 20 Fire Protection Shop Drawings and Submittals
21 01 50 Fire Protection Materials and Methods
21 05 53 Identification for Fire Suppression Piping and Equipment
21 13 00 Fire Suppression Sprinkler Systems

DIVISION 22 - PLUMBING
22 01 00 Plumbing General Requirements
22 01 20 Plumbing Shop Drawings and Submittals
22 01 50 Plumbing and Piping Materials and Methods
22 05 29 Hangers and Supports for Plumbing Piping and Equipment
22 05 53 Identification for Plumbing Piping and Equipment
22 07 19 Plumbing Piping Insulation
22 08 00 Commissioning for Plumbing
22 10 05 Plumbing Piping
22 10 06 Plumbing Piping Specialties
22 13 23 Sanitary Waste Interceptors
22 33 00 Plumbing Equipment
22 40 00 Plumbing Fixtures

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING
23 01 00 Mechanical General Requirements
23 01 20 Mechanical Shop Drawings and Submittals
23 01 50 Mechanical Materials and Methods
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 19 Meters and Gages for HVAC Piping
23 05 23 General-Duty Valves for HVAC Piping
23 05 29 Hangers and Supports for HVAC Piping and Equipment
23 05 53 Identification for HVAC Piping and Equipment
23 05 93 Testing, Adjusting, and Balancing for HVAC
23 07 13 Duct Insulation
23 07 16 HVAC Equipment Insulation
23 07 19 HVAC Piping Insulation
23 08 00 Commissioning of HVAC
23 09 00 Instrumentation and Control for HVAC
23 09 30 Kitchen Hood Ventilation Control System
23 09 34 Variable Frequency Motor Controllers for HVAC
23 09 93 Sequence of Operations for HVAC Controls
23 21 13 Hydronic Piping
23 21 14 Hydronic Specialties
23 21 23 Hydronic Pumps

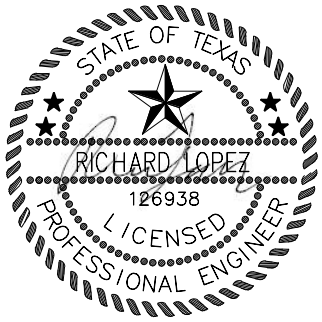
23 23 00 Refrigerant Piping
23 25 00 HVAC Water Treatment
23 31 00 HVAC Ducts and Casings
23 33 00 Air Duct Accessories
23 34 23 HVAC Power Ventilators
23 34 39 High Volume Low Speed Propeller Fans
23 36 00 Air Terminal Units
23 38 13.01 Residential Kitchen Range Hood for Commercial Buildings
23 38 13 Commercial Kitchen Hoods
23 51 00 Breeching, Chimneys, and Stacks
23 52 16 Condensing Boilers
23 64 23 Scroll Water Chillers
23 73 13 Modular Indoor Central-Station Air-Handling Units

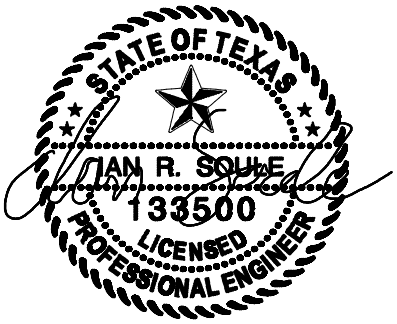
DIVISION 26 - ELECTRICAL
26 01 00 Electrical General Requirements
26 01 20 Electrical Shop Drawings and Submittals
26 05 19 Low-Voltage Electrical Power Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
26 05 29 Hangers and Supports for Electrical Systems
26 05 33.13 Conduit for Electrical Systems
26 05 33.16 Boxes for Electrical Systems
26 05 33.23 Surface Raceways for Electrical Systems
26 05 36 Cable Trays for Electrical Systems
26 05 53 Identification for Electrical Systems
26 05 73 Power System Studies
26 08 00 Commissioning of Electrical
26 09 23 Lighting Control Devices
26 21 00 Low Voltage Electrical Service Entrance
26 22 00 Low-Voltage Transformers
26 24 13 Switchboards
26 24 16 Panelboards
26 27 26 Wiring Devices
26 28 13 Fuses
26 28 16.13 Enclosed Circuit Breakers
26 28 16.16 Enclosed Switches
26 29 13 Enclosed Controllers
26 32 13 Engine Generators
26 36 00 Transfer Switches
26 36 33 Generator Docking Station
26 43 13 Surge Protective Devices
26 51 00 Interior Lighting
26 56 00 Exterior Lighting

DIVISION 27 - COMMUNICATION
27 00 00 Common Communications Requirements
27 05 03 Communications Shop Drawings and Submittals
27 05 10 Scope of the Communications Work

27 05 29 Hangers and Supports for Communications Systems
27 10 00 Structured Cabling Common Requirements
27 11 00 Communications Equipment room Fittings
27 11 16 Communications Racks, Frames, and Enclosures
27 13 23 Communications Optical Fiber Backbone Cabling
27 15 13 Communications Copper Horizontal Cabling
27 30 14 Voice Communication System for Elevators
27 41 16.00 Integrated Audio-Video Systems and Equipment – Common Requirements
27 41 16.55 Integrated Audio-Video Systems – Dining
27 41 16.56 Integrated Audio-Video Systems – Gymnasium
27 41 23 Audio-Video Cabling and Accessories
27 51 23 Intercommunications and Program Systems

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
28 00 00 Common Electronic Safety and Security Requirements
28 05 03 Electronic Safety and Security Shop Drawings and Submittals
28 05 10 Scope of the Electronic Safety and Security Work
28 10 00 Access Control
28 31 11 Intrusion Detection System
28 46 00 Fire Detection and Alarm





SECTION 00 01 13 – CIVIL TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

No. of Section	Title
01 32 23	Survey and Layout Data
01 55 13.10	Stabilized Construction Access
01 55 26	Traffic Control
01 57 10	TPDES Requirements
01 57 19	Temporary Environmental Controls
01 57 23	Temporary Storm Water Pollution Control
01 74 16	Site Maintenance
01 74 19	Construction Waste Management and Disposal

DIVISION 02 – EXISTING CONDITIONS

No. of Section	Title
02 41 13.10	Removing Existing Pavement and Structures

DIVISION 31 – EARTHWORK

No. of Section	Title
31 00 00	Site Earthwork
31 06 20.15	Cement Stabilized Sand
31 06 20.17	Utility Backfill Materials
31 11 00	Clearing and Grubbing
31 22 00	Site Grading
31 23 16.14	Trench Safety System
31 23 33	Excavation and Backfill for Utilities

DIVISION 32– EXTERIOR IMPROVEMENTS

No. of Section	Title
32 11 13.13	Lime-Treated Subgrades
32 11 29.13	Lime-Fly Ash-Treated Base Courses
32 13 13.00	Concrete Paving
32 13 13.10	Concrete Pavement Curing
32 13 13.25	Concrete Sidewalks
32 13 73	Concrete Paving Joints and Sealants
32 16 13	Curbs and Gutters
32 17 23	Pavement Markings

DIVISION 33 – UTILITIES

No. of Section	Title
33 05 13.00	Manholes and Structures
33 05 13.13	Manhole Grade Adjustment
33 05 16.13	Precast Concrete Utility Structures
33 05 16.16	Concrete for Utility Construction
33 06 10.14	Polyvinyl Chloride (PVC) Pipe
33 06 10.15	Ductile Iron Pipe and Fittings
33 06 40.10	HDPE Solid and Profile Wall Pipe
33 06 40.11	Reinforced Concrete Pipe
33 11 00	Water Utility Distribution Piping
33 12 13.10	Tapping Sleeves and Valves
33 12 13.12	Wet Connections
33 12 16	Water Utility Distribution Valves
33 12 19	Water Utility Distribution Fire Hydrants
33 12 40	Valve Boxes, Meter Boxes, and Meter Vaults
33 13 00.00	Disinfecting of Water Utility Distribution
33 13 00.10	Hydrostatic Testing of Pipelines
33 31 00.00	Sanitary Utility Sewerage Piping
33 31 00.10	Acceptance Testing for Sanitary Sewers
33 41 00	Storm Utility Drainage Piping
33 49 13	Storm Drainage Manholes, Frames and Covers

DOCUMENT 00 01 14 – LANDSCAPE TABLE OF CONTENTS

DIVISION 31 - EARTHWORK
31 22 16 Fine Grading
31 22 17 Topsoil

DIVISION 32 - EXTERIOR IMPROVEMENTS
32 01 90 Operation & Maintenance of Planting
32 84 00 Planting Irrigation
32 91 13 Soil Preparation
32 91 14 Planting Media
32 92 00 Turf and Grasses
32 92 13 Hydromulch Seeding
32 93 00 Plants

8/18/25

SECTION 21 01 00 - FIRE PROTECTION GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 APPLICABILITY

A. This section applies to and forms a part of each of the sections of Division 22. This section, and each of the sections to which it applies, is subject to the requirements of the Instructions to Bidders, General Conditions, and Special Conditions of these complete specifications.

B. The work covered by this Division of the Specifications consists of furnishing all labor, supervision, equipment, materials, all incidentals, related items, and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.

C. All work shall be finished, tested and ready for operation.

1.2 DEFINITIONS

A. Words "Material" or "Furnish" where written in Division 21 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.

B. Words "Labor" or "Install" where written in Division 21 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.

C. Word "Provide" where written in Division 21 specifications and drawings shall mean "Mechanical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".

1.3 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

A. Notify the Engineer of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.

B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.

C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.

D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished and installed.

E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.

F. Any work not clear to Contractor shall be referred to Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Engineer, whose decision is final, without additional charges.

G. By virtue of submitting a bid, Contractor agrees that they are skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that they have carefully reviewed all drawings, all specifications, and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

1.4 DRAWINGS

A. All piping shall be routed so as not to obstruct access to other equipment (i.e. VAV box controls, electrical devices, fire alarm devices, etc.). It shall be this contractor’s responsibility to coordinate with other trades for accessibility.

B. Any work or system on the roof not explicitly indicated on the roof plan shall be approved by the engineer prior to installing.

C. In general, the fire protection drawings are drawn to scale as noted. Obtain dimensions and locations of partitions, walls, etc., from the Architectural drawings wherever possible and do not scale the drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.

D. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.5 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the contractor requesting or submitting such substitutions shall advise all such contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractor's responsibility to coordinate any changes with the effected contractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.6 PRIOR APPROVAL REQUEST

A. Requests for substitution of materials and/or equipment other than those named in the specifications may be made to the Architect/Engineer. The request shall include complete information, test, etc. relating to quality, performance, and suitability. All requests shall be in the Architects/Engineers office not later than ten (10) days prior to the Bidding date. All approved requests shall be included in the project addenda.

1.7 INSTRUCTION OF OWNER'S EMPLOYEES

A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.

B. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.

C. Instruction of Owner's Employees" form at end of this section shall be filled out and signed by Contractor and Owner's Representative and three (3) signed copies of form sent to Engineer.

1.8 INSTALLATION OF EQUIPMENT

A. All appliances and equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications. Auxiliary piping, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.

1.9 RECORD DRAWING

A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.

B. The contractor shall note on the record drawings the elevations and/or inverts of all mechanical services (i.e., sewer, water, etc.) where they exit the building foundation. The contractor shall also record dimensions from the building to points on all mechanical equipment installed (ie., fuel tanks, oil piping, etc.).

C. A complete set of these drawings shall be scanned at a resolution of 600dpi in color and saved in an Adobe PDF portfolio format with index to each sheet by name and burned to a non-volatile media. The electronic copy of the as-built drawings shall be transmitted to the Architect. After review and approval by the Architect, the as-built drawings will be turned over to the Owner.

1.10 COOPERATION WITH OTHER TRADES

A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set the piping and/or re-route the duct work where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

B. The Contractor shall furnish to other trades, as required, all necessary electrical characteristics, templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

1.11 EQUIPMENT SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc.

1.12 PIPE MOUNTING HEIGHTS

A. All exposed or concealed piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping, insofar as possible, routed perpendicular or parallel to the building structure.

1.13 PREFABRICATED SYSTEMS

A. It is the contractor's responsibility to verify fit and function of any contractor prefabricated system prior to fabrication and delivery of system to project site for installation including above and below grade system. If any unforeseen conditions are encountered after the system has been prefabricated rendering system unusable, the contactor will not be compensated for materials and labor of the prefabricated system.

1.14 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themself with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.15 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.16 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

1.17 CODES, ORDINANCES, REGULATIONS & STANDARDS

A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.

B. All work shall conform to applicable state and local codes, ordinances, regulations and/or standards.

1.18 PERMITS AND LICENSES

A. This contractor shall obtain and pay for all licenses and permits and shall pay for all fees and charges for the connection to outside services and use of property other than the site of the work for storage of materials or other purposes.

B. Contractor shall coordinate and request all inspections from authority having jurisdiction. The Contractor shall notify the Architect of all such coordinated inspections (date & time) and shall submit certificates of inspection and final approval of the local inspection authority.

1.19 TEST

A. Test all equipment installed under these specifications and demonstrate its proper operation to the Engineer.

B. Do not test or operate equipment for any purpose, until it has been fully lubricated in accordance with the manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to the piping system with sufficient water so that it will not run dry.

C. All testing shall be completed before final inspection, and test results shall be available during the final inspection.

1.20 GUARANTEES

A. This contractor shall guarantee all equipment, material, and workmanship for a period of one year from date of final certificate. Any defects in mechanical equipment, workmanship or materials that appear, or cause trouble of any kind within a period of one year from date of final certificate shall be remedied, free of charge. Refer to other sections of these specifications for guarantees in excess of the requirements herein described.

1.21 CONSTRUCTION CLOSEOUT DOCUMENTS

A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an NA where items don’t pertain.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

3.2 **INSTRUCTION TO OWNER'S EMPLOYEES FORM**

DATE _____

INSTRUCTION OF OWNER'S EMPLOYEES

This letter shall certify that the Contractor has furnished the Owner with full instructions in the care and operation of all parts of the mechanical system as specified under Section 23 0100 paragraph entitled "Instruction of Owner's Employees".

	Owner's Initial Instructions			Owner's Follow-up Instructions		
Section	**Hours**	**Date**	**Initials**	**Hours**	**Date**	**Initials**
Fire Sprinkler						
Fire Pumps						

END OF SECTION

SECTION 21 01 20 - FIRE PROTECTION SHOP DRAWINGS AND SUBMITTALS

PART 1 GENERAL

1.1 SHOP DRAWINGS

A. Contractor shall submit for acceptance to the Architect shop drawings specified for the equipment indicated in these specifications. The shop drawings shall include the following minimum information:
   1. The equipment manufacturer’s name and address.
   2. Catalog designation or model number.
   3. Rough-in data & dimensions.
   4. Performance curves and rated capacities & operational characteristics.
   5. Equipment specific wiring diagrams.
   6. Electrical characteristics.
   7. Warranty information.

B. All submittals shall be electronic in PDF format, hard copies will not be accepted.

C. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to submittal. Each shop drawing set shall be stamped, signed, and dated indicating Contractor review.
   1. If the Contractor fails to properly review shop drawings, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.

D. Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, comply with the following:
   1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with “Compliance”. Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
      a. “C” for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
      b. “D” for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
      c. “A” for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
      d. “N/A” for Not Applicable: By noting the term “not applicable” or “N/A” in the margin, it shall be understood that the specified item is not applicable to the project.

E. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.

F. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.

G. The Engineer will review all Shop Drawings submitted.

H. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:

1. “Reviewed” indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation. Shop drawings that are returned "Reviewed" or "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
2. “Furnished as Corrected” indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time. If the corrections are accepted by the contractor, shop drawings that are returned "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
3. “Revised and Resubmit” indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at their discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
4. “Rejected” indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.

I. If the Engineer rejects (Revised and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews. Contractor is responsible for all delays caused by the resubmittal process.

J. Should the contractor fail to comply with any of the requirements of the preceding sub-paragraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.

K. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

L. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.2 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.3 SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.4 MANUALS

A. In addition to catalog data and shop drawings submitted for review, this contractor shall furnish Systems Manuals (O&M's):
   1. The Contractor Shall provide an electronic copy in PDF format. The PDF shall contain:
      a. Approved Shop Drawings of all major components.
      b. Parts lists for the same components.
      c. Manufacturer's operating, maintenance, and cleaning instructions.
      d. List of materials recommended for maintenance.
      e. Factory startup reports.
      f. Valve tag list.
      g. Name and address of authorized service organization and parts depot.
      h. Chemical Treatment Analysis Reports for heating & cooling systems.
      i. Radiographic Testing Reports of welded pipe with picture of weld & location plan showing physical location of where test was performed.
      j. A description of how the components of a given HVAC system interact within the large system. For example, circulating pumps, boilers, unit heaters are part of the "heating system".
      k. A description of normal operating conditions for the system and its components.
      l. A description of common symptoms of a malfunctioning system and likely causes.
      m. Warranty letter from the automatic temperature controls contractor indicating the warranty period for their portion of the work.
      n. Signed owner instruction forms for all items specified as requiring owners' instruction.
   2. The Systems manual shall have an electronic index and be broken up by individual systems such as "heating", "shop exhaust", "kitchen ventilation and exhaust", "chilled water", "administration ventilation".
   3. Include at the front of the manual a complete listing of the Architect, Engineer and contractors and sub-contractors used on the project. Listing shall include names, addresses and phone numbers for each.

4. All major pieces of equipment shall be referenced with the equipment supplier's name, address and phone number shall be provided.
5. Where indicated in the Specifications, the Contractor shall provide the services of a factory trained representative to instruct the Owner's authorized personnel in the operation, control, and maintenance of equipment.

B. Operations and Maintenance Manuals shall be submitted to the Engineer for approval prior to delivery to the Architect.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 21 01 50 - FIRE PROTECTION MATERIALS AND METHODS

PART 1 GENERAL

1.1 APPLICABILITY

A. This section covers basic materials and methods and applies to and forms a part of each of the sections of Division 21.

B. This work shall be in accordance with this and other applicable sections and/or provisions of these specifications and with the applicable drawings.

1.2 MATERIALS AND MANUFACTURERS

A. All materials and equipment shall be new, free of defects, installed in accordance with manufacturer's current published recommendations in a neat manner and in accordance with standard practice of the industry.

B. Certain materials and/or equipment in this specification are specified by manufacturer and catalog numbers. The design was based on the specified equipment and establishes a degree of quality, performance, physical configuration, etc. If the contractor should elect to use equipment other than the equipment used as a basis for design but listed as "acceptable" in the specifications, he shall be responsible for space requirements, configuration, performance, and changes in bases, supports, vibration isolators, structural members, openings in structure and other apparatus that may be affected by its use.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 COORDINATION OF OPENINGS

A. This contractor shall coordinate all openings required for new piping, equipment, controls, etc. through any structural slabs, beams, or walls. Contractor shall request a copy of the precast concrete shop drawings and verify locations and sizes of all openings required.

B. All costs associated with structural field changes or redesigns of the building systems due to lack of field coordination shall be responsibility of this contractor.

3.2 PROTECTION, DELIVERY AND STORAGE OF MATERIALS

A. Make provisions for the delivery and storage of materials and make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.

B. Protect materials and equipment stored on site from weather and moisture by maintaining factory covers and/or suitable weather-proof coverings. For extended outdoor storage, motors shall be removed from equipment and stored separately.

C. The open ends of all piping shall be covered whenever that system is not being worked on, i.e. end of the workday, completion of a section, etc. Covering shall keep dust, garbage, vermin, and other foreign objects out of the piping when the contractor is not on the jobsite.

3.3 CUTTING AND REPAIRING

A. All holes and penetrations required for the installation of the fire protection equipment shall be by the fire protection contractor. This shall include all piping and any other penetration through the wall, floor, or roof.

B. Cutting construction shall be done only with the written permission of the Architect. Cutting shall be done carefully and damage to buildings, pipes, wiring, or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional charge to the Owner. This Contractor shall be responsible for all cutting and patching unless such work has been delegated to the General Contractor.

C. All holes cut into concrete shall be cut by means of power saws or core drills. All unsightly spalls or chips shall be repaired.

D. All openings remaining around pipe penetrations shall be filled, caulked, and painted to match wall. Code approved fire caulking shall be used for all rated penetrations.

3.4 SEALING FLOOR, CEILINGS AND WALL OPENINGS

A. Where pipes pass through walls, ceilings, floors, or partitions, (other than those through fire rated walls or chases) the opening in the construction around the pipe shall not exceed ½ inch average clearance on all sides and shall be sealed to prevent the passage of sound and air. Coordinate wall openings to allow insulation thickness to pass through walls if allowed.

B. The material used to seal space between the wall and the pipe shall be non-combustible caulk type, or wrap type, as conditions require. Provide sheet metal angles or flanges as may be required to contain the stopping material. Use of expanding foam will be allowed if surfaces are cleaned of an excess material and all edges are trimmed smooth. Penetrations through exterior walls shall be sealed weather tight.

C. Special attention shall be given to penetrations of mechanical room walls. Fill gaps around entire exterior area of the pipes with sound insulation (batt or mineral wool) to within ½” of the wall surface. Use silicone caulking to finish filling the opening smooth with the wall surface or provide sheet metal angles. All sealer shall meet flame spread 25 and smoke developed less than 50.

D. Where pipes pass through fire-rated walls, ceilings, floors, vertical service shafts walls, or partitions, the opening in the construction around the pipe or duct shall be fire-stopped to prevent the passage of flame and smoke. All assemblies shall be UL or ASTM listed to provide a fire rating equal to that of the construction being penetrated. For the firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests shall be submitted from the manufacturer to the local authorities having jurisdiction for their review and approval prior to installation. Individuals installing the firestopping shall be experienced and certified as required by the manufacturer whose product is being applied. Refer to firestopping spec section for more information.

E. Manufacturer's assembly drawings shall be provided in O & M Manuals for each type of penetration. Printed metal or plastic labels shall be permanently applied on the structure within 6" of the edge of the firestop system. Metal labels shall be applied with mechanical fasteners & plastic labels shall be the self-adhering type with adhesive capable of permanently bonding labels to the surfaces on which the labels are placed. The information required on the label include UL/ASTM assembly number, date of installation, fire stopping material manufacture name, Contractor's name, address & phone number & the installer's name.

F. Acceptable manufacturers shall be Hilti, 3M Brand, or a prior approved product.

3.5 CLEANING AND PAINTING

A. Clear away all debris, surplus materials, etc., resulting from work or operations, leaving the job and equipment furnished under this contract in a clean condition.

B. All equipment being furnished with finished paint coat shall be examined upon job completion for scratches and other surface damage. All finished surfaces where necessary shall be touched up with touch-up paint of color to match the factory finish.

C. Paint all exposed bare pipe exterior of the building. Bare pipe shall be painted one coat of No. 7769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Final coat shall be of a color selected by the architect.

D. Paint all exposed iron and steel work, pipe hangers, pipe stands, uninsulated tanks, supporting steel for equipment and exposed bare pipe in mechanical areas. Iron and steel work and bare pipe shall be painted one coat of No. 4769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Iron and steel work shall be painted black.

E. Refer to Section 09 900, Painting for additional requirements.

3.6 ASBESTOS FREE BUILDING

A. There shall be no products or building materials used as a temporary or permanent element in the construction of this building, which has in its make-up any form of asbestos. The contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building and remind material suppliers that their products must be asbestos free.

B. Notify the Architect immediately of any existing materials which are suspected of containing asbestos. Do not disturb or attempt to remove any asbestos containing material. The Architect will contact the Owner and inform them of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos removal.

3.7 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

END OF SECTION

SECTION 21 05 53 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Ceiling tacks.

1.2 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3 SUBMITTALS

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

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Major Control Components: Nameplates.

D. Pumps: Nameplates.

E. Valves: Tags and ceiling tacks where above lay-in ceilings.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Background Color: Black.
   3. Thickness: 1/8 inch.
   4. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Use tags on piping 3/4 inch diameter and smaller.

D. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 21 13 00 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.2 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 1963 - Standard for Fire Hose Connections; 2019.

D. UL (DIR) - Online Certifications Directory; Current Edition.

E. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - 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. Shop Drawings:
1. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
2. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.

D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Designer's qualification statement.

F. Installer's qualification statement.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements for additional provisions.
2. 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.

1.4 QUALITY ASSURANCE

A. Comply with FM (AG) requirements.

B. Designer's qualification statement. The designer shall be a licensed individual and certify the following:
1. The layout is within the scope of the applicable prescriptive codes or standards, such as the National Fire Protection Association (NFPA) Standard 13 "Standard for the Installation of Sprinkler Systems" as specified, or adopted by the state or local jurisdiction.
2. The licensed individual currently holds a valid Responsible Managing Employee License (RME) issued by the Texas State Fire Marshal's Office, in accordance with the Texas Insurance Code Article 5.43-3.
3. The licensed individual is certified to a minimum Level III, in the subfield of "Automatic Sprinkler Systems Layout", through the National Institute for Certification in Engineering Technologies (NICET).
4. Upon completion of the installation a licensed individual, where given the specific authority by Texas Statute, will certify in writing that the installation meets the standards provided for by law and/or is in compliance with the plans and specifications of the licensed professional engineer.

C. Equipment and Components: Provide products that bear FM (AG) label or marking.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
1. Anvil International: www.anvilintl.com/#sle.
2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
3. Victaulic Manufacturing Co; www.victaulic/#sle
4. Viking Corporation: www.vikinggroupinc.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 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. Provide fire department connections where indicated.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.3 SPRINKLERS

A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Enamel, color White unless noted otherwise .
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Pendant type.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3.
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

E. Guards: Finish to match sprinkler finish.

F. Flexible Drop System: Stainless steel, multiple use, open gate type, annular corrigated 1 inch ID hose.
   1. Application: Use to properly locate sprinkler heads.
   2. Include all supports and bracing.
   3. Provide braided, corrigated type tube as required for the application.
   4. Manufacturers:
      a. FlexHead Industries, a brand of ASC Engineered Solutions: www.asc-es.com/#sle.
      b. Victaulic Company: www.victaulic.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 PIPING SPECIALTIES

A. 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.

B. 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.

C. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.

D. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

E. 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.

F. Fire Department Connections:
1. Type: Free standing made of corrosion resistant metal complying with UL 405.
a. Inlets: Storz type connection. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
b. Finish: Chrome.
c. Sleeve: Brass, 18 inches height.
d. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

2.5 AIR COMPRESSOR

A. Compressor: Single-unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

B. Electrical Characteristics:
1. 1/3 hp.
2. 125 volts, single phase, 60 Hz.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate outside alarm gong on building wall as indicated.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. 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.

G. Flush entire piping system of foreign matter.

H. Install guards on sprinklers where indicated.

I. Hydrostatically test entire system.

J. Require test be witnessed by Fire Marshal.

3.2 SCHEDULES

A. System Hazard Areas:
1. Offices: Light Hazard.

END OF SECTION

SECTION 22 01 00 - PLUMBING GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 APPLICABILITY

A. This section applies to and forms a part of each of the sections of Division 22. This section, and each of the sections to which it applies, is subject to the requirements of the Instructions to Bidders, General Conditions, and Special Conditions of these complete specifications.

B. The work covered by this Division of the Specifications consists of furnishing all labor, supervision, equipment, materials, all incidentals, related items, and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.

C. All work shall be finished, tested and ready for operation.

1.2 DEFINITIONS

A. Words "Material" or "Furnish" where written in Division 22 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.

B. Words "Labor" or "Install" where written in Division 22 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.

C. Word "Provide" where written in Division 22 specifications and drawings shall mean "Mechanical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".

1.3 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

A. Notify the Engineer of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.

B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.

C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.

D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished and installed.

E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.

F. Any work not clear to Contractor shall be referred to Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Engineer, whose decision is final, without additional charges.

G. By virtue of submitting a bid, Contractor agrees that they are skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that they have carefully reviewed all drawings, all specifications, and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

1.4 DRAWINGS

A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, connections, and accessories which may be required. Furnish offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.

B. All piping shall be routed so as not to obstruct access to other equipment (i.e. VAV box controls, electrical devices, fire alarm devices, etc.). Routing indicated on drawings is representative of intended location but shall be field verified. It shall be this contractor’s responsibility to coordinate with other trades for accessibility.

C. Any work or system on the roof not explicitly indicated on the roof plan shall be approved by the engineer prior to installing.

D. In general, the plumbing equipment drawings are drawn to scale as noted. Obtain dimensions and locations of partitions, walls, etc., from the Architectural drawings wherever possible and do not scale the mechanical drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.

E. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.5 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractor's responsibility to coordinate any changes with the effected contractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.6 PRIOR APPROVAL REQUEST

A. Requests for substitution of materials and/or equipment other than those named in the specifications may be made to the Architect/Engineer. The request shall include complete information, test, etc. relating to quality, performance, and suitability. All requests shall be in the Architects/Engineers office not later than ten (10) days prior to the Bidding date. All approved requests shall be included in the project addenda.

1.7 INSTRUCTION OF OWNER'S EMPLOYEES

A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.

B. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.

C. The number of man hours of instruction furnished for each system shall be as specified below. Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 75% of time used for an initial instruction and 25% of time used for a follow up instruction, a minimum of four (4) weeks after initial instruction.

D. Instruction of Owner's Employees" form at end of this section shall be filled out and signed by Contractor and Owner's Representative and three (3) signed copies of form sent to Engineer.

E. Owner training and instructions:
1. Ventilation systems including but not limited to packaged rooftop units shall not be less than four (4) man hours.
2. Automatic temperature control systems including all components of the system shall be not less than eight (8) man hours.

1.8 INSTALLATION OF EQUIPMENT

A. All appliances and equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications. Auxiliary piping, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.

C. As a part of the work of this contract, the Contractor shall make any changes in the pulleys, belts, and dampers, and shall install additional dampers required for correct balance as recommended by air balance agency, at no additional cost to the Owner.

D. The use of permanent HVAC systems for temporary heating, cooling, ventilating, and conditioning is strictly prohibited without written authorization from the Engineer.

1.9 RECORD DRAWING

A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.

B. The contractor shall note on the record drawings the elevations and/or inverts of all mechanical services (i.e., sewer, water, etc.) where they exit the building foundation. The contractor shall also record dimensions from the building to points on all mechanical equipment installed (ie., fuel tanks, oil piping, etc.).

C. A complete set of these drawings shall be scanned at a resolution of 600dpi in color and saved in an Adobe PDF portfolio format with index to each sheet by name and burned to a non-volatile media. The electronic copy of the as-built drawings shall be transmitted to the Architect. After review and approval by the Architect, the as-built drawings will be turned over to the Owner.

1.10 COOPERATION WITH OTHER TRADES

A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set the piping and/or re-route the duct work where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

B. The Contractor shall furnish to other trades, as required, all necessary electrical characteristics, templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

1.11 EQUIPMENT SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc.

1.12 PIPE MOUNTING HEIGHTS

A. All exposed or concealed piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, routed perpendicular or parallel to the building structure.

1.13 PREFABRICATED SYSTEMS

A. It is the contractor's responsibility to verify fit and function of any contractor prefabricated system prior to fabrication and delivery of system to project site for installation including above and below grade system. If any unforeseen conditions are encountered after the system has been prefabricated rendering system unusable, the contactor will not be compensated for materials and labor of the prefabricated system.

1.14 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themself with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.15 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.16 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

1.17 CODES, ORDINANCES, REGULATIONS & STANDARDS

A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.

B. All work shall conform to applicable state and local codes, ordinances, regulations and/or standards.

1.18 PERMITS AND LICENSES

A. This contractor shall obtain and pay for all licenses and permits and shall pay for all fees and charges for the connection to outside services and use of property other than the site of the work for storage of materials or other purposes.

B. Contractor shall coordinate and request all inspections from authority having jurisdiction. The Contractor shall notify the Architect of all such coordinated inspections (date & time) and shall submit certificates of inspection and final approval of the local inspection authority.

1.19 TEST

A. Test all equipment installed under these specifications and demonstrate its proper operation to the Engineer.

B. Do not test or operate equipment for any purpose, until it has been fully lubricated in accordance with the manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to the piping system with sufficient water so that it will not run dry.

C. Submit to the Engineer water balance reports indicating test results as hereinafter specified under Section 230593 "TESTING, ADJUSTING AND BALANCING FOR HVAC".

D. All testing shall be completed before final inspection, and test results shall be available during the final inspection.

1.20 GUARANTEES

A. This contractor shall guarantee all equipment, material, and workmanship for a period of one year from date of final certificate. Any defects in mechanical equipment, workmanship or materials that appear, or cause trouble of any kind within a period of one year from date of final certificate shall be remedied, free of charge. Refer to other sections of these specifications for guarantees in excess of the requirements herein described.

1.21 CONSTRUCTION CLOSEOUT DOCUMENTS

A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an NA where items don’t pertain.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 **INSTRUCTION TO OWNER'S EMPLOYEES FORM**

DATE _____

INSTRUCTION OF OWNER'S EMPLOYEES

This letter shall certify that the Contractor has furnished the Owner with full instructions in the care and operation of all parts of the mechanical system as specified under Section 23 0100 paragraph entitled "Instruction of Owner's Employees".

	Owner's Initial Instructions			**Owner's Follow-up Instructions**		
Section	**Hours**	**Date**	**Initials**	**Hours**	**Date**	**Initials**
Special Piping						
Water Heaters						
Medical Gas						
Water Purification						
Pumps						
Control Systems						

3.2 NOT USED

END OF SECTION

SECTION 22 01 20 - PLUMBING SHOP DRAWINGS AND SUBMITTALS

PART 1 GENERAL

1.1 SHOP DRAWINGS

A. Contractor shall submit for acceptance to the Architect shop drawings specified for the equipment indicated in these specifications. The shop drawings shall include the following minimum information:
   1. The equipment manufacturer’s name and address.
   2. Catalog designation or model number.
   3. Rough-in data & dimensions.
   4. Performance curves and rated capacities & operational characteristics.
   5. Equipment specific wiring diagrams.
   6. Electrical characteristics.
   7. Warranty information.

B. All submittals shall be electronic in PDF format, hard copies will not be accepted.

C. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to submittal. Each shop drawing set shall be stamped, signed, and dated indicating Contractor review.
   1. If the Contractor fails to properly review shop drawings, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.

D. Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, comply with the following:
   1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with “Compliance”. Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
      a. “C” for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
      b. “D” for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
      c. “A” for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
      d. “N/A” for Not Applicable: By noting the term “not applicable” or “N/A” in the margin, it shall be understood that the specified item is not applicable to the project.

E. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.

F. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.

G. The Engineer will review all Shop Drawings submitted.

H. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:

1. “Reviewed” indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation. Shop drawings that are returned "Reviewed" or "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
2. “Furnished as Corrected” indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time. If the corrections are accepted by the contractor, shop drawings that are returned "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
3. “Revised and Resubmit” indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at their discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
4. “Rejected” indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.

I. If the Engineer rejects (Revised and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews. Contractor is responsible for all delays caused by the resubmittal process.

J. Should the contractor fail to comply with any of the requirements of the preceding sub-paragraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.

K. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

L. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.2 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.3 SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.4 MANUALS

A. In addition to catalog data and shop drawings submitted for review, this contractor shall furnish Systems Manuals (O&M's):
   1. The Contractor Shall provide an electronic copy in PDF format. The PDF shall contain:
      a. Approved Shop Drawings of all major components.
      b. Parts lists for the same components.
      c. Manufacturer's operating, maintenance, and cleaning instructions.
      d. List of materials recommended for maintenance.
      e. Factory startup reports.
      f. Valve tag list.
      g. Name and address of authorized service organization and parts depot.
      h. Chemical Treatment Analysis Reports for heating & cooling systems.
      i. Radiographic Testing Reports of welded pipe with picture of weld & location plan showing physical location of where test was performed.
      j. A description of how the components of a given HVAC system interact within the large system. For example, circulating pumps, boilers, unit heaters are part of the "heating system".
      k. A description of normal operating conditions for the system and its components.
      l. A description of common symptoms of a malfunctioning system and likely causes.
      m. Warranty letter from the automatic temperature controls contractor indicating the warranty period for their portion of the work.
      n. Signed owner instruction forms for all items specified as requiring owners' instruction.
   2. The Systems manual shall have an electronic index and be broken up by individual systems such as "heating", "shop exhaust", "kitchen ventilation and exhaust", "chilled water", "administration ventilation".
   3. Include at the front of the manual a complete listing of the Architect, Engineer and contractors and sub-contractors used on the project. Listing shall include names, addresses and phone numbers for each.

4. All major pieces of equipment shall be referenced with the equipment supplier's name, address and phone number shall be provided.
5. Where indicated in the Specifications, the Contractor shall provide the services of a factory trained representative to instruct the Owner's authorized personnel in the operation, control, and maintenance of equipment.

B. Operations and Maintenance Manuals shall be submitted to the Engineer for approval prior to delivery to the Architect.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 22 01 50 - PLUMBING AND PIPING MATERIALS AND METHODS

PART 1 GENERAL

1.1 APPLICABILITY

A. This section covers basic materials and methods and applies to and forms a part of each of the sections of Division 22.

B. This work shall be in accordance with this and other applicable sections and/or provisions of these specifications and with the applicable drawings.

1.2 MATERIALS AND MANUFACTURERS

A. All materials and equipment shall be new, free of defects, installed in accordance with manufacturer's current published recommendations in a neat manner and in accordance with standard practice of the industry.

B. Certain materials and/or equipment in this specification are specified by manufacturer and catalog numbers. The design was based on the specified equipment and establishes a degree of quality, performance, physical configuration, etc. If the contractor should elect to use equipment other than the equipment used as a basis for design but listed as "acceptable" in the specifications, he shall be responsible for space requirements, configuration, performance, and changes in bases, supports, vibration isolators, structural members, openings in structure and other apparatus that may be affected by its use.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 COORDINATION OF OPENINGS

A. This contractor shall coordinate all openings required for new piping, equipment, controls, etc. through any structural slabs, beams, or walls. Contractor shall request a copy of the precast concrete shop drawings and verify locations and sizes of all openings required.

B. All costs associated with structural field changes or redesigns of the building systems due to lack of field coordination shall be responsibility of this contractor.

3.2 PIPE AND FITTING INSTALLATION

A. Plastic DWV piping shall be installed as addressed by ICC (IPC) or IAPMO (UPC) code section on Expansion and Contraction. Any straight runs of plastic DWV piping exceeding 30 feet shall be installed to accommodate thermal expansion.

B. Piping is to be installed as shown on the drawings as much as practical. When a pipe size is not indicated, the subcontractor shall request the pipe size from the Architect through the Plumbing Contractor.

C. Provide sufficient swing joints, expansion loops, and/or devices necessary and install so as to permit free expansion and contraction of piping without causing undue stresses. Make all changes in direction with fittings. Support piping independently at all equipment so that its weight shall not be supported by the equipment.

D. Install piping without springing or forcing and clear all windows, doors, and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted.

E. All pipes shall be reamed to full pipe diameter before joining.

F. Install vertical risers plumb and straight, horizontal lines parallel with walls and partitions. Conceal piping above ceilings and within furring and/or walls when practical.

G. Provide shut-off valves and unions suitably located to isolate each item of equipment, branch circuit or section of piping.

H. Provide 1/2" drain valves at all low points of each system to enable complete drainage.

I. Provide "Clearflow" dielectric waterways at all junctions of dissimilar metals in potable water systems.

J. All piping shall be adequately supported from the building structure with adjustable hangers to maintain uniform grading where required and to prevent sagging or pocketing.

K. Provide supports between piping and building structure where necessary to prevent swaying.

L. The use of wire or perforated metal to support pipe will not be permitted.

3.3 PROTECTION, DELIVERY AND STORAGE OF MATERIALS

A. Make provisions for the delivery and storage of materials and make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.

B. Protect materials and equipment stored on site from weather and moisture by maintaining factory covers and/or suitable weather-proof coverings. For extended outdoor storage, motors shall be removed from equipment and stored separately.

C. The open ends of all piping shall be covered whenever that system is not being worked on, i.e. end of the workday, completion of a section, etc. Covering shall keep dust, garbage, vermin, and other foreign objects out of the piping when the contractor is not on the jobsite.

3.4 CUTTING AND REPAIRING

A. All holes and penetrations required for the installation of the plumbing equipment shall be by the plumbing contractor. This shall include all piping, ductwork, and any other penetration through the wall, floor, or roof.

B. Cutting construction shall be done only with the written permission of the Architect. Cutting shall be done carefully and damage to buildings, pipes, wiring, or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional charge to the Owner. This Contractor shall be responsible for all cutting and patching unless such work has been delegated to the General Contractor.

C. All holes cut into concrete shall be cut by means of power saws or core drills. All unsightly spalls or chips shall be repaired.

D. All openings remaining around duct and pipe penetrations shall be filled, caulked, and painted to match wall. Code approved fire caulking shall be used for all rated penetrations.

3.5 SEALING FLOOR, CEILINGS AND WALL OPENINGS

A. Where pipes pass through walls, ceilings, floors, or partitions, (other than those through fire rated walls or chases) the opening in the construction around the pipe shall not exceed ½ inch average clearance on all sides and shall be sealed to prevent the passage of sound and air. Coordinate wall openings to allow insulation thickness to pass through walls if allowed.

B. The material used to seal space between the wall and the pipe shall be non-combustible caulk type, or wrap type, as conditions require. Provide sheet metal angles or flanges as may be required to contain the stopping material. Use of expanding foam will be allowed if surfaces are cleaned of an excess material and all edges are trimmed smooth. Penetrations through exterior walls shall be sealed weather tight.

C. Special attention shall be given to penetrations of mechanical room walls. Fill gaps around entire exterior area of the pipes with sound insulation (batt or mineral wool) to within ½” of the wall surface. Use silicone caulking to finish filling the opening smooth with the wall surface or provide sheet metal angles. All sealer shall meet flame spread 25 and smoke developed less than 50.

D. Where pipes pass through fire-rated walls, ceilings, floors, vertical service shafts walls, or partitions, the opening in the construction around the pipe or duct shall be fire-stopped to prevent the passage of flame and smoke. All assemblies shall be UL or ASTM listed to provide a fire rating equal to that of the construction being penetrated. For the firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests shall be submitted from the manufacturer to the local authorities having jurisdiction for their review and approval prior to installation. Individuals installing the firestopping shall be experienced and certified as required by the manufacturer whose product is being applied. Refer to firestopping spec section for reposition finned element to be centered under windows as required.more information.

E. Manufacturer’s assembly drawings shall be provided in O & M Manuals for each type of penetration. Printed metal or plastic labels shall be permanently applied on the structure within 6” of the edge of the firestop system. Metal labels shall be applied with mechanical fasteners & plastic labels shall be the self-adhering type with adhesive capable of permanently bonding labels to the surfaces on which the labels are placed. The information required on the label include UL/ASTM assembly number, date of installation, fire stopping material manufacture name, Contractor’s name, address & phone number & the installer’s name.

F. Acceptable manufacturers shall be Hilti, 3M Brand, or a prior approved product.

3.6 CLEANING AND PAINTING

A. Clear away all debris, surplus materials, etc., resulting from work or operations, leaving the job and equipment furnished under this contract in a clean condition.

B. All equipment being furnished with finished paint coat shall be examined upon job completion for scratches and other surface damage. All finished surfaces where necessary shall be touched up with touch-up paint of color to match the factory finish.

C. Paint all exposed bare pipe exterior of the building. Bare pipe shall be painted one coat of No. 7769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Final coat shall be of a color selected by the architect.

D. Paint all exposed iron and steel work, pipe hangers, pipe stands, uninsulated tanks, supporting steel for equipment and exposed bare pipe in mechanical areas. Iron and steel work and bare pipe shall be painted one coat of No. 4769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Iron and steel work shall be painted black.

E. Refer to Section 09 900, Painting for additional requirements.

3.7 ASBESTOS FREE BUILDING

A. There shall be no products or building materials used as a temporary or permanent element in the construction of this building, which has in its make-up any form of asbestos. The contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building and remind material suppliers that their products must be asbestos free.

B. Notify the Architect immediately of any existing materials which are suspected of containing asbestos. Do not disturb or attempt to remove any asbestos containing material. The Architect will contact the Owner and inform them of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos removal.

3.8 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

END OF SECTION

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.

B. Strut systems for pipe or equipment support.

C. Beam clamps.

D. Pipe hangers.

E. Pipe supports, guides, shields, and saddles.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 50 00 - Metal Fabrications.

1.3 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; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

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 (2022).

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 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

O. UL (DIR) - Online Certifications Directory; Current Edition.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 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 03 30 00.

1.5 SUBMITTALS

A. See Section 01 30 00 - 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. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

PART 2 PRODUCTS

2.1 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. 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.

D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

E. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
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.

F. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.2 PREFABRICATED TRAPEZE-FRAMED SYSTEMS

A. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
2. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

B. Roof Piping Support System:
1. Manufacturer: Eaton, Dura-Blok DB series or equal.
2. Materials:
   a. Curb Base: Rubber and polyurethane prepolymer with a uniform load capacity of 500 punds per linear foot of support.
   b. Dimensions: 6 inch wide, height and lenght as required.
   c. Steel Frame: Steel, strut galvanized per ASTM A653/A653M or strut galvanized per ASTM A653/A653M for bridge series.
   d. Steel, strut galvanized per or strut galvanized per ASTM A653 for bridge series.
   e. Attaching Hardware: Zinc-plated threatded rod, nuts and attaching hardware per ASTM B633.

2.3 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. 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.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch: 1/4 inch diameter.
   c. Piping larger than 1 inch: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

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.

2.4 BEAM CLAMPS

A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

B. C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.

C. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).

D. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.

E. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.

F. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish.

G. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. 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.

2.5 PIPE HANGERS

A. Band Hangers, Adjustable:
1. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

B. Clevis Hangers, Adjustable:
1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.

2.6 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.

B. Extension Split Pipe Clamp:
1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
3. Provide hanger rod and nuts of the same type and material for a given pipe run.
4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

2.7 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. U-Bolts:
1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

C. Pipe Shields for Insulated Piping:
1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Service Temperature: Minus 40 to 178 degrees F.
e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

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 clamps.
b. Support From Below: MSS SP-58 types 35 through 38.

E. 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.
b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
c. Minimum Thickness: 60 mil, 0.06 inch.

F. PEX-a Pipe Supports:
1. Non-combustible, self-gripping, galvanized-steel channel for crosslinked polyethylene (PEX-a) pipe. Must meet ASTM E84 plenum applications for use in return air plenum applications.

PART 3 EXECUTION

3.1 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. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, 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 thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

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

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tags.

B. Pipe markers.

C. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2020.

1.4 SUBMITTALS

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

B. Schedules:
   1. Submit plumbing component identification schedule listing equipment, piping, and valves.
   2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
   3. Valve Data Format: Include id-number, location, function, and model number.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Equipment: Nameplate and Ceiling tack when located above ceiling.

B. Piping: Stencile or Pipe Marker.

C. Valves, (manual and control type): Valve Tag and Ceiling tack when located above ceiling.

2.2 TAGS

A. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

B. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.3 PIPE MARKERS

A. Comply with ASME A13.1.

B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

C. Identification Scheme, ASME A13.1:
1. Primary: External Pipe Diameter, Uninsulated or Insulated.
a. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
b. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
2. Secondary: Color scheme per fluid service.
a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

2.4 CEILING TACKS

A. Description: Adhesive backed 3/4 inch diameter sticker, color coded.

B. Color code as follows:
1. Plumbing Equipment: Yellow.
2. Plumbing Valves: Green.

PART 3 EXECUTION

3.1 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.

B. Install tags in clear view and align with axis of piping

C. Apply ASME A13.1 Pipe Marking Rules:
1. Place pipe marker adjacent to changes in direction.
2. Place pipe marker adjacent each valve port and flange end.
3. Place pipe marker at both sides of floor and wall penetrations.
4. Place pipe marker every 25 to 50 feet interval of straight run.

D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Glass fiber insulation.

C. Jacketing and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - 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.

PART 2 PRODUCTS

2.1 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.

2.2 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: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 650 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.3 GLASS FIBER, FLEXIBLE

A. Manufacturer:
1. CertainTeed Corporation: 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. Insulation: ASTM C553; flexible, noncombustible blanket.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. 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.

2.5 JACKETING AND ACCESSORIES

A. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. 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.

E. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

3.3 SCHEDULES

A. Plumbing Systems, Metallic:
   1. Domestic Hot Water Supply and Recirculation:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 1/2 inch and greater.
         2) Thickness: 1 inch.
   2. Domestic Cold Water:
      a. Piping located above ceiling or with-in interior walls
         1) Insulation not required.
      b. Piping located with-in exterior walls:
         1) 3/4 inch thick flexible elastomeric cellular insulation.
   3. Roof Drain Bodies:
      a. Glass Fiber Insulation, Flexible or Ridge:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1 inch.
   4. Roof Drainage Piping, Above Slab Horizontal Exposed:
      a. Glass Fiber Insulation, Semi-Ridged:

1) Pipe Size Range: All pipe sizes.
2) Thickness: 1 inch.

5. Roof Drainage Piping, Above Slab Horizontal Concealled:
   a. Glass Fiber Insulation, Flexible:
      1) Pipe Size Range: All pipe sizes.
      2) Thickness: 1 inch.

B. PEX Piping Systems, Return Air Plenum Applications: Above ceiling conditions are considered a return air plenum, insulate individual fittings per manufacture requirements for plenum return applications and the following minimum requirements.
   1. Domestic Hot Water Supply and Recirculation Piping
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 1/2 inch and greater.
         2) Thickness: 1/2 inch.
   2. PEX Fittings: Glass fiber insulation per PEX manufacturer requirements.
   3. Piping located in exterior walls: Insulation is not required.

END OF SECTION

SECTION 22 08 00 - COMMISSIONING OF PLUMBING

PART 1 GENERAL

1.1 RELATED WORK

A. Division 23 - HVAC

B. Division 26 - Electrical

1.2 REFERENCES

A. Drawings and general provisions of contract, including general and supplementary conditions, general mechanical provisions and Division-1 Specification sections, apply to work of this section.

B. ASHRAE Guideline 1-1996

C. ASHRAE Guideline 0-2005

D. ACG Commissioning Guideline – 2005

1.3 DESCRIPTION OF WORK

A. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the mechanical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers.

B. The independent commissioning agent (CA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 ROLES OF THE COMMISSIONING AGENCY

A. The primary point of responsibility is to inform the construction manager, the owner and design team on the status, integration, and performance of Plumbing systems within the facility.

B. The CA shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owner's O&M staff.

C. Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

D. The CA shall observe and coordinate testing as required to assure system performance meets the design intent.

E. The CA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded.

F. The CA shall provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.

G. The CA is to remain an independent party with specific knowledge of the project. The CA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CA shall monitor resolution for conformance with design intent and prevailing industry standards.

H. The CA shall document the date of acceptance as determined by the construction manager, owner and design team. System Verification Checklists and Functional Performance Test results may be used in determining the start of the warranty period for Plumbing systems and subsystems.

I. The CA will review operating and maintenance materials for Plumbing systems.

J. The CA will review phasing plans as provided by the GC relating to temporary use of Plumbing equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

3.2 SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

A. Domestic Hot Water

B. Automatic Flush Valves

3.3 PLUMBING COMMISSIONING PLAN

A. Commissioning Team
1. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:
   a. Program Manager (PrM)
   b. Facilities Management Division (FMD)
   c. Commissioning Agent (CA)

d. Design Team (DT)
e. General Contractor (GC)
f. GC's Mechanical Contractor (MC)
g. GC's Plumbing Contractor (PC)
h. Controls Contractor (CC)
i. Test and Balance Contractor (TABC)
j. Electrical Contractor (EC)

B. Basis of Design Document
1. The Basis of Design Document (BOD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BOD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.
2. The CA will review the BOD documents for adequate commissioning provisions, functional performance, optimization of performance, accessibility, TAB provisions, and O&M considerations.

C. Commissioning Meetings
1. Commissioning meetings will be held in conjunction with progress meetings as necessary. Commissioning meetings will be used to address any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users and owners.

D. Resolution Tracking Forms (RTF)
1. The use of Resolution Tracking Forms is a method employed by the CA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
2. The CA will regularly submit RTF’s to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

E. System Verification Checklists (SVC) / Manufacturers’ Checklists
1. The MC/PC shall provide SVC’s based on the manufacturers start-up procedures. These tests will be created for systems and subsystems. See SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS. Draft copies will be submitted to the CT for review and comment prior to placement on the job site. A master copy of the SVC’s will be bound in a three-ring binder and placed on the job site for use by the installing contractors. No system will be started until the appropriate SVC’s have been completed.
2. The CA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CA.
3. The equipment manufacturers’ checklists must also be reviewed by the CA prior to start-up. These lists must be completed by the installing contractor, and reviewed by the CA before start-up can commence.

F. Start-Up
1. The appropriate contractors and/or manufacturer’s representative will be required on site to perform start-up. No system will be started until the appropriate SVC’s have been completed. No system will be started until the Manufacturer’s checklists have been completed. Start-up will be performed according to the Manufacturer’s recommended procedures. The CA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting Plumbing equipment.

2. CT members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-authorized technician will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the BoD.

G. Functional Performance Tests (FPT)
1. The CA will write FPT's based on the BoD. These tests will be created for systems and subsystems. See SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS above.
2. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CA and the owner's maintenance staff. Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, the TAB report has been submitted and reviewed, and the completion of the control system has been documented through point-to-point checklists and other documentation.
3. The Functional Performance Tests shall include Plumbing and related equipment.
   a. Hot water system will be tested.
   b. Heat Exchangers will be tested under relevant operating conditions.
   c. DDC control systems will be tested as necessary.
4. Deferred Testing
   a. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by the appropriate parties and test rescheduled.
   b. Off-season mode testing will be implemented as necessary to assure conformance with the BoD. Installing contractors will be expected to participate as required by the project specifications.
5. Rescheduled Functional Performance Test
   a. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, contractor shall reimburse the owner for all additional costs the owner incurs as a result of the contractor's failure to be complete and/or to provide operating compliant systems for commissioning. Additional costs include but are not limited to additional fees of $1500.00 per day charged by the architect, engineer, construction manager and commissioning agent.
   b. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed $1500.00 per day for the commissioning personnel's return trip.

H. Building Turn-Over / Owner Orientation / User Training
1. The CA will assist contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.
2. The CA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.
3. Owner training will be coordinated with the assistance of the CA. The training will be provided by the installing contractor, or manufacturer's representative, and witnessed by the CA. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The CA will visit the site during the Turn-Over and Training period to assure that any on-going Plumbing related problems are being addressed and corrected in a timely and efficient manner.
4. The CA will assist the owner/user with warranty issues.

5. The CA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

3.4 RESPONSIBILITIES OF TEAM MEMBERS

A. General Contractor (GC)
1. Include commissioning requirements in the mechanical, electrical, and controls contracts, as well as other subcontracts, to assure full cooperation of all parties in the Plumbing commissioning process.
2. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the mechanical commissioning program as described in the contract documents.
3. Assure that the CA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
4. Coordinate inclusion of commissioning activities in the construction schedule.
5. Facilitate resolution of deficiencies identified by observation or performance testing.
6. Assist the CA in monitoring the duct leakage testing.

B. GC's Plumbing Contractor (PC)
1. Include cost for commissioning requirements in the contract price.
2. Attend commissioning meetings scheduled by the CA.
3. Verify proper installation and performance of all plumbing services provided.
4. Complete System Verification Checklists and manufacturer’s pre-start checklists prior to scheduling startup of equipment.
5. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
6. Provide an electrical system technician to assist during verification and performance testing.
7. Participate in the Functional Performance Tests as required to achieve design intent.
8. Participate in the off-season mode testing as required to achieve design intent.
9. Participate in O&M Training as required by project specifications.

END OF SECTION

SECTION 22 10 05 - PLUMBING PIPING

PART 1 GENERAL

1.1 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. Butterfly valves.

M. Balancing valves.

N. Pressure reducing valves.

O. Pressure relief valves.

P. Pressure-temperature valves.

Q. Strainers.

1.2 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 22 07 19 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).

B. ANSI Z223.1 - National Fuel Gas Code; 2021.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

E. ASME B16.12 - Cast Iron Threaded Drainage Fittings; 2025.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

H. ASME B31.1 - Power Piping; 2022.

I. ASME B31.9 - Building Services Piping; 2020.

J. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.

K. 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; 2023.

L. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems; 2020.

M. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

N. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

O. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

P. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.

Q. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

R. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe; 2022.

S. ASTM B32 - Standard Specification for Solder Metal; 2020.

T. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

U. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

V. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

W. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

X. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

Y. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

Z. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.

AA. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

BB. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

CC. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

DD. 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.

EE. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

FF. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

GG. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024.

HH. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2024.

II. 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; 2023b.

JJ. ASTM F2023 - Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water; 2021.

KK. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

LL. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.

MM. AWWA C606 - Grooved and Shouldered Joints; 2022.

NN. AWWA C651 - Disinfecting Water Mains; 2014, with Addendum (2020).

OO. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

PP. 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.

QQ. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.

RR. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

SS. MSS SP-67 - Butterfly Valves; 2022.

TT. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

UU. NFPA 54 - National Fuel Gas Code; 2021.

VV. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

WW. NSF 372 - Drinking Water System Components - Lead Content; 2022.

XX. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; 2021.

1.4 SUBMITTALS

A. See Section 01 30 00 - 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.

1.5 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

2.1 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.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.3 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.

B. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc: www.uponorengineering.com/#sle.
      b. Raupex.
      c. Watts.
   2. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.
   3. Fittings: Below slab fittings are not allowed.
   4. Fittings: Brass and engineered polymer (EP) ASTM F1960.
   5. Joints: Below slab joints are not allowed.
   6. Joints: ASTM F1960 cold-expansion fittings.

2.5 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.

B. Cross-Linked Polyethylene (PEX-a) Pipe: ASTM F876, SDR 9 manufactured using the Engel-method.
   1. Tested to comply with ASTM F2023 requirements for minimum chlorine resistance.
   2. Cold-expansion Fittings: ASTM F877 or ASTM F1960, lead-free brass or engineered polymer (EP) fitting utilizing cold-expansion PEX-a reinforcing rings.
      a. All PEX-a piping shall be provided with PEX-a pipe supports, coordinate sizing of support with manufacturer.
   3. Metal to PEX Transition Fittings:
      a. Flanges: ASME B16.5 , Class 150, with ASTM F1960 cold-expansion end.
      b. Groove Adapter: One CSA B242-05 groove end and one ASTM F1960 cold-expansion end.
   4. PPI TR-4 Pressure Design Basis:
      a. 80 psig at maximum 200 degrees F.
      b. 100 psig at maximum 180 degrees F.
      c. 160 psig at maximum 73.4 degrees F.
   5. Fittings: Third-party certified to NSF/ANSI 14 and ASTM F1960 cold-expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types: engineered polymer (EP), brass, and lead-free (LF) brass.
   6. Joints: ASTM F1960 cold-expansion fittings.
   7. Multiport Tees and Elbows: : Multiple-outlet fitting complying with ASTM F877; with ASTM F1960 inlets and outlets.
   8. Transition Fittings:
      a. PEX-to-Metal Transition Fittings:
         1) Manufacturers: Provide fittings from the same manufacturer of the piping.
         2) Third-party certified to NSF/ANSI 14 and ASTM F1960 cold expansion with PEX reinforcing ring and shall comply with ASTM F876 and ASTM F877, 1/2 inch through 3 inch nominal pipe size fittings manufactured from the following material types:

3) PEX-a to copper sweat transition: One-piece lead free (LF) brass fitting with sweat adapter and ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
4) PEX-a to copper press transition: One-piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
5) PEX-a to flange transition: Two-piece fitting with one steel flange conforming to ASME B 16.5 and one lead free (LF) brass adapter conforming to ASTM F1960.

b. PEX-toThermoplastic Transition Fittings:
1) PEX-a to CPVC transition: Thermoplastic fitting with one spigot or socket end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

2.6 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.

2.7 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Shelded Heavy Duty No-Hub Coupling.

2.8 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Polyethylene Pipe: ASTM D2513, SDR 11.
1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded.

2.9 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:
a. Gas pressure less than 0.5-psig: Threaded or Cold Press Mechanical Joints.
b. Gas pressure greater more than 0.5-psig and less than 5-psig: Welded to ASME B31.1 or Cold Press Mechanical Joints.

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:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

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. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   6. Manufacturers:
      a. Anvil International: www.anvilintl.com/#sle.
      b. Apollo Valves: www.apollovalves.com/#sle.
      c. Grinnell Products: www.grinnell.com/#sle.
      d. Victaulic Manufacturing Co; www.victaulic/#sle
      e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Shielded, Heavy Duty No-Hub Couplings:
   1. Testing: In accordance with ASTM C1540 and FM 1680.
   2. Gasket Material: Neoprene complying with ASTM C564.
   3. Band Material: Stainless steel.
   4. Eyelet Material: Stainless steel.
   5. Manufacturers:
      a. ANACO-Husky
      b. Clamp-All Corp
      c. Ideal Clamp Products, Inc; Yellow Shield Heavy Duty: www.idealtridon.com//#sle.
      d. Tyler Pipe: a subsidiary of McWane Inc.
      e. MIFAB, Inc; MI-QXHUB: www.mifab.com/#sle.
      f. Substitutions: See Section 01 60 00 - Product Requirements.

E. No-hub Cast Iron Piping Restraints:
   1. CISPI 301 large diameter no-hub cast iron fittings, 6 inch and larger in size, with supplemental support to minimize the risk of joints separation under high thrust conditions. Auxiliary restraint products used shall be manufactured assemblies with thrust pressure rating adequate for the specific installation. Field devised methods and materials are not permitted.
   2. Manufacturers:
      a. Holdrite No Hub Fitting Restraints.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Cold Press Mechanical Joints:
   1. Manufacturers:
      a. Viega MegaPress
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Mechanical joint fitting system shall conforming to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI LC-4/CSA 6.32.
   3. Piping shall be meet the requirements of ASTM A53/A53M and ASTM A106/A106M Schedule 40 carbon steel pipe.
   4. Pipe and fittings shall comply with ANSI LC-4/CSA 6.32 and the latest edition of NFPA 54.

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. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

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.

2.12 BALL VALVES

A. 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 BUTTERFLY VALVES

A. Construction 1-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

B. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.14 BALANCING VALVES

A. 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.

B. Manual Operated Y-Pattern Globe, Size 1/2 to 2 inch:
1. Class 125, brass or bronze body, multi-turn handwheel, memory stop, variable orifice, soldered connections, dual PT (hot and cold pressure-temperature) test ports for 300 psi, minus 4 to 250 deg F WOG service.

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.

2.15 PRESSURE REDUCING VALVES

A. 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.

B. 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.

2.16 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.17 PRESSURE-TEMPERATURE VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.18 STRAINERS

A. 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.

B. Size 2 inch and Smaller:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. Provide bentonite “trench plug” that extends at least 5 feet out from the face of the building’s exterior.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 incheseach side of pipe.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.3 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice but not before completing the following.
   1. Testing and inspecting underground utilities.
   2. Removing trash and debris.

B. Trench backfill from 6” below pipe to 12” above shall be bank sand.

C. Place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of bed sand or subbase material in 6 inch lifts, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

3.4 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cast-iron soil piping according to CISPI 301 and CISPI 310.
   1. Install encasement on underground piping according to ASTM A674 or AWWA C105/A21.5.

C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

F. Install piping to maintain headroom, conserve space, and not interfere with use of space.

G. Group piping whenever practical at common elevations.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
   1. See Section 22 07 19.

I. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.

J. Install water piping to ASME B31.9.

K. 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.

L. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

M. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.

N. 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.

O. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. Provide bentonite “trench plug” that extends at least 5 feet out from the face of the building’s exterior.

P. Fire wrap all PVC or CPVC piping installed in return air plenums.

Q. PEX Piping Installation:
   1. Install domestic water piping according to approved shop drawings and coordination drawings.
   2. Install PEX piping system in compliance with the maufacturer's requirements.
   3. PEX shall not be installed in areas within five feet of a UV light source, such as LED and fluorescent light fixtures or other UV-generating devices.
   4. White or blue PEX shall not be installed outdoors where it is exposed to direct sunlight for more than one month; red PEX shall not be installed outdoors where it is exposed to direct sunlight for more than six months.
   5. Install PEX piping free of kinks.
   6. Above Ground Installation:
      a. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following.

1) PEX piping shall be installed per ASTM E84 requirements for plenum applications.
2) Install PEX-a Pipe Support and provide all required hangers and supporting strapping as required by manufacturer to provide a code compliant installation.
3) Install PEX piping in straight runs free of sags and kinks and provide bend supports at all 1/2 inch and 3/4 inch drops.
4) All PEX piping penetrations through wall plates shall be protected or shielded as required to prevent damage to piping.
5) PEX tubing passing through metal studs shall use grommets or sleeves at the penetration.Install PEX piping from the multiport tee or manifold to each fixture as a home run.
6) Install PEX-a Pipe Support, fixed anchor points, and hangers in compliance with the manufacturer's requirements to minimize expansion and contraction.
7) Install PEX piping at each fixture with out of the wall support bracket to secure piping and prevent excess movement when water stops or shut valves are operated.
8) Install all PEX manifolds centered in access panels to permit servicing.

b. Below-ground Installation:
1) PEX piping penetrations through slabs shall be protected by PEX stand-up brackets or PVC bend supports to prevent damage to piping.
2) Install PEX piping from the manifold as a home run. No joints shall be installed below the slab.

7. PEX-a Hangers and Supports:
a. Horizontal PEX-a piping: Install supports suitable for PEX-a piping in compliance with local codes.
1) Note: Per ICC PMG-1006, the above maximum hanger spacing requirements may be extended with the use of a continuous support channel.
b. Horizontal PEX-a piping with PEX-a Pipe Support: Install supports for PEX-a piping with horizontal support channel in accordance with manufacturer's recommendations and the following maximum spacing:
1) 3 inch nominal and smaller: Maximum span, 8 feet.
2) Support 1-1/2 inch and smaller fittings within 12 inches.
3) Install clamps and fixed points per the manufacturer’s recommendations.
c. Vertical PEX-a piping: Install supports suitable for PEX-a piping in compliance with local codes:
1) Support vertical in-wall piping every 5 feet.
2) Support riser piping at the base of each floor and every 5 feet vertically.

8. PEX-a Piping schedule:
a. Above ground domestic water piping shall be the following:
1) 3 inch and smaller:
(a) PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings.

3.5 APPLICATION

A. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install globe valves for throttling, bypass, or manual flow control services.

D. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

E. Provide spring-loaded check valves on discharge of water pumps.

3.6 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

3.7 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
   1. Perform hydrostatic testing for leakage prior to system disinfection.
   2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
   3. General:
      a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.

C. Gas Distribution Systems:
   1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
   2. General Systems:
      a. Inject a minimum of 10 psi of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
      b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound.
   3. Welded Pipes or Systems with Service Pressures Above 14 in-wc:
      a. Inject a minimum of 60 psi of compressed air into the piping system for a duration of 30 minutes and verify with a gauge that no perceptible pressure drop is measured.
      b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound with 1 psi increments.

D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

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.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.9 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, and sand strainer.

3.10 ACCEPTABLE PIPING SCHEDULES

A. Domestic Water Piping, Above Ground:
1. PEX: 3 inch and less.
2. Copper. Above 3 inch, Type K, Drawn with Solder or Press Sealed joints and fittings.

B. Domestic Water Piping, Below Slab:
1. PEX: 3 inch and less.

C. Sanitary Sewer Piping, Below Slab:
1. All Pipe Sizes:
a. Schedule 40 PVC with solvent fittings.

D. Sanitary Sewer Piping, Below Slab Connected to High Temperature Discharge (i.e. Commercial Dishwasher and Tilt-skillets/kittles):
1. When connecting to a high temperature discharge the first 10 feet of piping shall be Extra Heavy Weight Cast Iron with hub-and-spigot joints.

E. Sanitary Sewer & Vent Piping, Above Ground:
1. All Pipe Sizes:
a. Hubless, cast-iron soil pipe and fittings with heavy-duty hubless-piping couplings.

F. Storm Sewer Piping, Above Ground
1. 4 inch and less:
a. Hubless, cast-iron soil pipe and fittings with heavy-duty hubless-piping couplings.
2. Greater than 4 inch:
a. Hubless, cast-iron soil pipe and fittings with heavy-duty hubless-piping couplings and no-hub cast iron pipe fitting restraints at all changes in direction 45 degrees or greater.

G. Natural Gas Piping:
1. Above Slab Piping:
a. Less than 0.5 psig:
1) All Pipe Sizes: Schedule 40 with cold pressed or welded joints.
b. Greater than 0.5 psig and less than 5 psig:
1) 1-inch and less: Schedule 40 with cold pressed or welded joints.
2) Grater than 1-inch: Schedule 40 steel with cold pressed or welded joints.
2. Below Slab Piping:
a. Less than 5.0 psig:
1) Schedule 40 with welded joints and vented contanment conduit.
(a) Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
(b) Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

H. Pipe Hanger Spacing: Size per manufacture recommendations with maximum spacing as follows.
   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.
      e. Pipe Size: 8 inch to 12 inch:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger Rod Diameter: 7/8 inch.
      f. Pipe Size: 14 inch and Over:
         1) Maximum Hanger Spacing: 20 ft.
         2) Hanger Rod Diameter: 1 inch.
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft.
         2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 10 06 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.

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. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

E. NSF 372 - Drinking Water System Components - Lead Content; 2022.

F. PDI-WH 201 - Water Hammer Arresters; 2017.

1.2 SUBMITTALS

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

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Josam Company: www.josam.com/#sle.
3. MIFAB, Inc: www.mifab.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 01 60 00 - 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:
   a. Membrane flange and membrane clamp with integral gravel stop.

b. Adjustable under deck clamp.
c. Roof sump receiver.
d. Waterproofing flange.
e. Adjustable extension sleeve for roof insulation.
f. O-ring seal between male and female connection pipes.

5. Manufacturers:
   a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   b. Josam Company: www.josam.com/#sle.
   c. MIFAB, Inc: www.mifab.com/#sle.
   d. Zurn Industries, LLC: www.zurn.com/#sle.

C. Floor Drains:
1. Manufacturers:
   a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   b. Josam Company: www.josam.com/#sle.
   c. MIFAB, Inc: www.mifab.com/#sle.
   d. Zurn Industries, LLC: www.zurn.com/#sle.
2. Refer to drawing schedule for type and size.

2.3 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Josam Company: www.josam.com/#sle.
3. MIFAB, Inc: www.mifab.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 HOSE BIBBS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. MIFAB, Inc: www.mifab.com/#sle.
3. Watts Regulator Company: www.wattsregulator.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 HYDRANTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
2. MIFAB, Inc: www.mifab.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 WASHING MACHINE OUTLET BOXES

A. Box Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.

B. Description: Plastic preformed rough-in box with brass valves with single lever handle, socket for 2 inch waste, slip in finishing cover.

2.7 CONDENSATE DRAIN BOXES

A. Manufacturers:
1. Basic Lab Controls
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Model BLC-CDB/TG-01, 9-7/8" wide by 7-3/4" high x 4" deep fully welded stainless steel drain box. Provide with the following options:
1. 2-inch drain outlet with trap guard
2. Lockable front cover with piano hinge.
3. 2-inch condensate reservoir to prevent overflow and splash out.

2.8 ICE MAKER OUTLET BOXES

A. Box Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Plastic preformed square or round rough-in box with brass quarter-turn ball valve, and slip-in finishing cover.

2.9 THERMOSTATIC BALANCE VALVE

A. Manufacturers:
1. ThermOmega Tech
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Thermostatic Balance Valve:
1. The valve shall be certified lead free according to NSF/ANSI 61 standards.
2. The valve body shall be constructed out of stainless steel.
3. The valve shall be rated for 200 PSIG working pressure and 250°F max. temperature.
4. The valve shall have a fixed, non-adjustable (tamper proof) temperature setpoint; temperature setpoints range from 80°F to 170°F in 5°F increments.
5. The valve shall have a temperature accuracy of ±3.0°F (±1.7°C).
6. The valve shall have a wax thermostatic element.

C. Required Accessories:
1. Integrated check valve.
2. Shut off valves at inlet and outlet, match valve connections with piping type, i.e. PEX ends, Union or ProPress.

2.10 BACKFLOW PREVENTERS

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com/#sle.
3. MIFAB, Inc: www.mifab.com/#sle.
4. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
5. Zurn Industries, LLC: www.zurn.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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 full port ball valves.
3. Maximum Working Parameters: 175 psi at 180 degrees F.
4. Accessories: Provide air gap fitting, lead-free Y-strainer, and test cocks.

C. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013 and NSF 61 compliant stainless steel body assembly with corrosion resistant internal parts, stainless steel springs, 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. Configured to protect against backsiphonage and backpressure into potable water supply.
3. Size: 2-1/2 to 10 inch assembly with flanged OS&Y gate valves.
4. Accessories: Provide flanged Y-strainer and test cock.

2.11 DOUBLE CHECK-VALVE ASSEMBLIES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. MIFAB, Inc: www.mifab.com/#sle.
3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 01 60 00 - 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.
3. Accessories: Provide lead-free Y-strainer.

2.12 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Precision Plumbing Products: www.pppinc.net/#sle
3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.13 FLOOR DRAIN TRAP SEALS

A. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

2.14 ELECTRONIC TRAP-SEAL PRIMERS

A. Description: Enclosed electronic trap seal primer system with timer.

PART 3 EXECUTION

3.1 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. Install floor cleanouts at elevation to accommodate finished floor.

D. 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.

E. Pipe relief from backflow preventer to nearest drain.

F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or washing machine outlets.

G. 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

SECTION 22 13 23 - SANITARY WASTE INTERCEPTORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Grease interceptors.

1.2 REFERENCE STANDARDS

A. ASME A112.14.3 - Hydromechanical Grease Interceptors; 2022.

B. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
   1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

PART 2 PRODUCTS

2.1 HYDROMECHANICAL GREASE INTERCEPTOR

A. Seamless, molded polyethylene with minimum 3/4" uniform wall thickness.

B. Furnished for below-grade installation with adjustable cover adapter and access restrictor built into each cover adapter.

C. Interceptor shall be certified to ASME A112.14.3 (Type C).

D. Cover shall provide water/gas-tight seal and have minimum 16,000 lbs. load capacity.

E. Compliant to the ICC (IPC) and IAPMO (UPC).

PART 3 EXECUTION

3.1 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. 6 inches beneath bottom of concrete slabs-on-grade.
e. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.2 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
1. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.3 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements.

D. Set tops of grating frames and grates flush with finished surface.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.5 IDENTIFICATION

A. Identification materials and installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial gas-fired water heaters.

B. Water filters.

C. Point-of-use water filters.

D. In-line circulator pumps.

1.2 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.

B. NSF 42 - Drinking Water Treatment Units – Aesthetic Effects; 2023.

C. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.3 SUBMITTALS

A. See Section 01 30 00 - 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. Provide electrical characteristics and connection requirements.

C. Shop Drawings:

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Certifications:
1. Water Heaters: NSF approved.

1.5 WARRANTY

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

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Manufacturers:
1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
2. Bock Water Heaters, Inc: www.bockwaterheaters.com/#sle.
3. Bradford White Corporation: www.bradfordwhite.com/#sle.
4. Rheem Manufacturing Company: www.rheem.com/#sle.

B. Commercial Gas-Fired Water Heaters:
1. Manufacturers:
a. A.O. Smith Water Products Co: www.hotwater.com/#sle.
b. Bock Water Heaters, Inc: www.bockwaterheaters.com/#sle.
c. Rheem Manufacturing Company: www.rheem.com/#sle.
d. Bradford White Corporation: www.bradfordwhite.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Type: Automatic, natural gas-fired, vertical storage.
3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
4. Performance: Refer to drawing schedule.
5. Tank: Antimicrobial-infused, enamel-lined, welded steel,; 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.
e. Temperature and Pressure Relief Valve: ASME labeled.
7. Applications:
a. Automatic storage water heater.
b. For operation at 180 degrees F.
8. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

2.2 WATER FILTERS

2.3 POINT-OF-USE WATER FILTERS

A. Point-of-Use Application: Provide for ice makers and Drinking fountains.

B. Type: Disposable, side positioned, line or tap installed cartridge, canister, or showerhead filter.

C. Construction: Polymer based material housing with built-in female threaded connections, and internal specific or composite filtering media such as activated carbon, sand, gravel, calcite, limestone, or other mineral media suitable to reduce intended contaminants.

D. Internal Filter Media: Chemical-free, pH-resilient materials proven to reduce bacteria, chlorine, odors, sediment, and trace metals down to the 0.2 micron particle size.

E. Maximum Service Requirements: 100 psi and 130 degrees F.

2.4 IN-LINE CIRCULATOR PUMPS

A. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

B. Impeller: Bronze.

C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

D. Seal: Carbon rotating against a stationary ceramic seat.

E. Drive: Flexible coupling.

2.5 SCALE FORMATION PROTECTION SYSTEM

A. Manufacturer: Watts OneFlow

B. Tank: 125 PSI working pressure.

C. Mineral:
1. System shall be free from the use of any salts and/or chemical additives.
2. Media contained within the system shall be tested and certified for material safety to NSF 42 and NSF 61 .

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate system, equipment, and piping work with applicable electrical, fuel, gas, vent, drain, and waste support interconnections as included or provided by other trades.

C. 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

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

B. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

C. ASME A112.18.2 - Plumbing Waste Fittings; 2020.

D. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2018.

E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.

F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

G. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

H. EPA (EPACT) - Energy Policy Act of 2005; 2005.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

J. NSF 2 - Food Equipment; 2021.

K. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.2 SUBMITTALS

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

B. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
   1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements of EPA (EPACT) related to about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Enameled, Cast-Iron Fixtures: ASME A112.19.1
2. Stainless-Steel Commercial, Handwash Sinks: NSF 2.
3. Vitreous-China Fixtures: ASME A112.19.2
4. Shower Trim: ASME A112.18.2
5. Water-Closet, Flushometer: ASME A112.18.1 or ASME A112.19.5.
6. Emergency Showers: ANSI Z358.1.
7. Emergency Thermostatic Mixing Valves: ASSE 1070.

PART 2 PRODUCTS

2.1 PLUMBING FIXTURES AND TRIM

A. Refer to fixture schedule on drawings for additional fixture and trim requirements.

B. Available Manufacturers:
1. Vitreous China:
   a. American Standard.
   b. Koehler.
   c. Zurn.
   d. Toto.
   e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Stainless Steel Sinks:
   a. Elkay.
   b. Just Manufacturing.
   c. Substitutions: See Section 01 60 00 - Product Requirements.
3. Faucets:
   a. Chicago Faucets.
   b. Kohler Company.
   c. T&S Brass.
   d. Toto Corporation.
   e. Zurn Industries.
   f. Substitutions: See Section 01 60 00 - Product Requirements.
4. Flush Valves:
   a. Sloan.
   b. Zurn.
   c. Toto.
   d. Substitutions: See Section 01 60 00 - Product Requirements.
5. Toilet Seats:
   a. American Standard.
   b. Bernis Manufacturing.
   c. Church Seat Company.
   d. Olsonite.
   e. Substitutions: See Section 01 60 00 - Product Requirements.
6. Angle Stops and P-traps:
   a. McGuire.
   b. Zurn.
   c. Substitutions: See Section 01 60 00 - Product Requirements.
7. Protective Shield Guards:
   a. Engineered Brass Co.
   b. McGuire Manufacturing Co., Inc.

c. TRUEBRO, Inc.
d. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
e. Substitutions: See Section 01 60 00 - Product Requirements.

8. Drinking Fountains:
   a. Elkay.
   b. Halsey Taylor.
   c. Haws.
   d. Substitutions: See Section 01 60 00 - Product Requirements.
9. Wash Fountains:
   a. Acorn Engineering Company.
   b. Bradley Corporation.
   c. Substitutions: See Section 01 60 00 - Product Requirements.
10. Shower Valves:
   a. Bradley.
   b. Leonard
   c. Symmons.
   d. Watts.
   e. Substitutions: See Section 01 60 00 - Product Requirements.
11. Emergency Eye Wash and Drench Showers:
   a. Therm-Omega-Tech, Inc..
   b. Speakman.
   c. Guardian.
   d. Haws.
   e. Substitutions: See Section 01 60 00 - Product Requirements.
12. Mop Sinks:
   a. Acorn Engineering Company.
   b. Kohler.
   c. Zurn.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

N. Install toilet seats on water closets.

O. Install trap-seal liquid in dry urinals.

P. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

R. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

S. Install shower flow-control fittings with specified maximum flow rates in shower arms.

T. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

U. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

V. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

W. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Replace washers and seals of leaking and dripping faucets and stops.

C. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 01 00 - MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 APPLICABILITY

A. This section applies to and forms a part of each of the sections of Division 23. This section, and each of the sections to which it applies, is subject to the requirements of the Instructions to Bidders, General Conditions, and Special Conditions of these complete specifications.

B. The work covered by this Division of the Specifications consists of furnishing all labor, supervision, equipment, materials, all incidentals, related items, and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.

C. All work shall be finished, tested and ready for operation.

1.2 DEFINITIONS

A. Words "Material" or "Furnish" where written in Division 23 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.

B. Words "Labor" or "Install" where written in Division 23 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.

C. Word "Provide" where written in Division 23 specifications and drawings shall mean "Mechanical Contractor shall furnish all labor and material and completely and properly install such material and leave same in acceptable condition and intended acceptable working order".

1.3 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

A. Notify the Engineer of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.

B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.

C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.

D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished and installed.

E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.

F. Any work not clear to Contractor shall be referred to Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Engineer, whose decision is final, without additional charges.

G. By virtue of submitting a bid, Contractor agrees that they are skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that they have carefully reviewed all drawings, all specifications, and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

1.4 DRAWINGS

A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, connections, and accessories which may be required. Furnish offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.

B. All piping and ductwork shall be routed so as not to obstruct access to other equipment (i.e. VAV box controls, electrical devices, fire alarm devices, etc.). Routing indicated on drawings is representative of intended location but shall be field verified. It shall be this contractor’s responsibility to coordinate with other trades for accessibility.

C. Any work or system on the roof not explicitly indicated on the roof plan shall be approved by the engineer prior to installing.

D. In general, the mechanical equipment drawings are drawn to scale as noted. Obtain dimensions and locations of partitions, walls, etc., from the Architectural drawings wherever possible and do not scale the mechanical drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.

E. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.5 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractor's responsibility to coordinate any changes with the effected contractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.6 PRIOR APPROVAL REQUEST

A. Requests for substitution of materials and/or equipment other than those named in the specifications may be made to the Architect/Engineer. The request shall include complete information, test, etc. relating to quality, performance, and suitability. All requests shall be in the Architects/Engineers office not later than ten (10) days prior to the Bidding date. All approved requests shall be included in the project addenda.

1.7 INSTRUCTION OF OWNER'S EMPLOYEES

A. Furnish, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.

B. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.

C. The number of man hours of instruction furnished for each system shall be as specified below. Hours of instruction shall be divided up into a minimum of two (2) instruction periods with 75% of time used for an initial instruction and 25% of time used for a follow up instruction, a minimum of four (4) weeks after initial instruction.

D. Instruction of Owner's Employees" form at end of this section shall be filled out and signed by Contractor and Owner's Representative and three (3) signed copies of form sent to Engineer.

E. Owner training and instructions:
1. Ventilation systems including but not limited to packaged rooftop units shall not be less than four (4) man hours.
2. Automatic temperature control systems including all components of the system shall be not less than eight (8) man hours.

1.8 INSTALLATION OF EQUIPMENT

A. All appliances and equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications. Auxiliary piping, valves, electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.

C. As a part of the work of this contract, the Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, and shall install additional dampers required for correct balance as recommended by air balance agency, at no additional cost to the Owner.

D. The use of permanent HVAC systems for temporary heating, cooling, ventilating, and conditioning is strictly prohibited without written authorization from the Engineer.

1.9 RECORD DRAWING

A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.

B. The contractor shall note on the record drawings the elevations and/or inverts of all mechanical services (i.e., sewer, water, etc.) where they exit the building foundation. The contractor shall also record dimensions from the building to points on all mechanical equipment installed (ie., fuel tanks, oil piping, etc.).

C. A complete set of these drawings shall be scanned at a resolution of 600dpi in color and saved in an Adobe PDF portfolio format with index to each sheet by name and burned to a non-volatile media. The electronic copy of the as-built drawings shall be transmitted to the Architect. After review and approval by the Architect, the as-built drawings will be turned over to the Owner.

1.10 COOPERATION WITH OTHER TRADES

A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set the piping and/or re-route the duct work where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

B. The Contractor shall furnish to other trades, as required, all necessary electrical characteristics, templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

1.11 EQUIPMENT SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc.

1.12 DUCT AND PIPE MOUNTING HEIGHTS

A. All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, routed perpendicular or parallel to the building structure.

1.13 PREFABRICATED SYSTEMS

A. It is the contractor's responsibility to verify fit and function of any contractor prefabricated system prior to fabrication and delivery of system to project site for installation including above and below grade system. If any unforeseen conditions are encountered after the system has been prefabricated rendering system unusable, the contactor will not be compensated for materials and labor of the prefabricated system.

1.14 INSPECTION OF SITE

A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize themself with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.15 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.16 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

1.17 CODES, ORDINANCES, REGULATIONS & STANDARDS

A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.

B. All work shall conform to applicable state and local codes, ordinances, regulations and/or standards.

1.18 PERMITS AND LICENSES

A. This contractor shall obtain and pay for all licenses and permits and shall pay for all fees and charges for the connection to outside services and use of property other than the site of the work for storage of materials or other purposes.

B. Contractor shall coordinate and request all inspections from authority having jurisdiction. The Contractor shall notify the Architect of all such coordinated inspections (date & time) and shall submit certificates of inspection and final approval of the local inspection authority.

1.19 TEST

A. Test all equipment installed under these specifications and demonstrate its proper operation to the Engineer.

B. Do not test or operate equipment for any purpose, until it has been fully lubricated in accordance with the manufacturer's instructions and, if it is a centrifugal pump, until it has been connected to the piping system with sufficient water so that it will not run dry.

C. Submit to the Engineer air balance and water balance reports indicating test results as hereinafter specified under Section 230593 "TESTING, ADJUSTING AND BALANCING FOR HVAC".

D. All testing shall be completed before final inspection, and test results shall be available during the final inspection.

1.20 GUARANTEES

A. This contractor shall guarantee all equipment, material, and workmanship for a period of one year from date of final certificate. Any defects in mechanical equipment, workmanship or materials that appear, or cause trouble of any kind within a period of one year from date of final certificate shall be remedied, free of charge. Refer to other sections of these specifications for guarantees in excess of the requirements herein described.

1.21 CONSTRUCTION CLOSEOUT DOCUMENTS

A. This Contractor and their subcontractors should proceed immediately to fully complete the work as listed at the end of this Section. The Contractor responsible shall initial and date the "Contractor Completed" column after each item as it is complete and forward a copy of the fully completed punch list to the Engineers for their final approval before final punch list inspection. Reply with an NA where items don’t pertain.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 **INSTRUCTION TO OWNER'S EMPLOYEES FORM**

DATE _____

INSTRUCTION OF OWNER'S EMPLOYEES

This letter shall certify that the Contractor has furnished the Owner with full instructions in the care and operation of all parts of the mechanical system as specified under Section 23 0100 paragraph entitled "Instruction of Owner's Employees".

	Owner's Initial Instructions			**Owner's Follow-up Instructions**		
Section	**Hours**	**Date**	**Initials**	**Hours**	**Date**	**Initials**
Special Piping						
Heat Generation						
Refrigeration						
Heat Transfer						
Ventilation						
Temperature Control						

3.2 LIST OF CONSTRUCTION CLOSEOUT DOCUMENTS

SECTION	**DOCUMENT**	**DATE/INITIALS**	**APPROVED**
23 01 00	Record drawings - heating		
23 01 00	Record drawings - ventilation		
23 01 00	Record drawings - controls		
23 01 00	O&M Manuals - heating		
23 01 00	O&M Manuals - ventilation		
23 01 00	O&M Manuals - controls		
23 01 00	Owner instruction - heating		

23 01 00	Owner instruction - ventilation		
23 01 00	Owner instruction - controls		
23 05 53	Valve, pipe, duct, equipment labeling & valve schedule		
23 05 93	Submit duct leakage test results		
23 05 93	Submit test & balance report		
23 07 13	Verify ductwork above ceiling fully insulated		
23 07 19	Verify piping above ceiling fully insulated		
23 09 23	Verify thermostats are programmed and calibrated		
23 0X XX	AHU coil vent/drains piped to exterior of AHU casing		
23 50 00	Insulated all valves, strainers, unions		
23 21 13	Submit dimensioned drawings of geothermal well field including corners, intermediate spot locations at perimeter, and record GPS coordinates		
23 21 13	Provide valid welding certification for welders		
23 21 23	Submit radiographic test results for underground welds including image, reading, report and location		
23 21 23	Inline pumps above 5 HP, factory start-up technician sign-off		
23 21 23	Base mounted pumps, factory start-up/alignment technician sign-off		
23 25 00	Provide heating/cooling system initial fill water analysis		
23 52 14	Fuel burning equipment set and adjusted by factory tech - sign-off		
23 50 00	Provide engineer with water analysis upon completion of filling system		
23 50 00	Provide independent lab results of water testing and glycol concentration		
23 50 00	Document glycol percentage before system turn-over		
23 50 00	Document glycol test 1 year post fill and replenish to specified percentage		
23 50 00	Provide documentation of extra sidestream filter cartridges turned over to owner		
23 52 14	Carbon monoxide control systems started by factory technician - sign-off		
23 52 14	Feed water pumps sign-off by factory trained installing technician		
23 64 26	Screw chiller factory start up technician sign-off		
23 XX XX	Provide wall escutcheon on pipe penetrations through walls and floors		

23 XX XX	Submit all factory/contractor start-up reports		
23 XX XX	Ensure all holes existing and new have been patched, all duct/pipe penetrations have been draft stopped or fire caulked and painted to match		
23 XX XX	Provide documentation that extra AHU filters specified have been turned over		
23 XX XX	Turn over all extra belts specified		
23 XX XX	Clean all mechanical areas of debris, wipe down all fixtures and equipment. Remove all extra material and garbage from site		
23 XX XX	All air handling equipment specified to have factory start-up, technician sign here		

END OF SECTION

SECTION 23 01 20 - MECHANICAL SHOP DRAWINGS AND SUBMITTALS

PART 1 GENERAL

1.1 SHOP DRAWINGS

A. Contractor shall submit for acceptance to the Architect shop drawings specified for the equipment indicated in these specifications. The shop drawings shall include the following minimum information:
   1. The equipment manufacturer’s name and address.
   2. Catalog designation or model number.
   3. Rough-in data & dimensions.
   4. Performance curves and rated capacities & operational characteristics.
   5. Equipment specific wiring diagrams.
   6. Electrical characteristics.
   7. Warranty information.

B. All submittals shall be electronic in PDF format, hard copies will not be accepted.

C. The Contractor shall thoroughly review each item for compliance with these Specifications making any necessary corrections prior to submittal. Each shop drawing set shall be stamped, signed, and dated indicating Contractor review.
   1. If the Contractor fails to properly review shop drawings, the Contractor shall reimburse the Engineer for all additional reviews on a time and material basis.

D. Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, comply with the following:
   1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with “Compliance”. Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
      a. “C” for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
      b. “D” for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
      c. “A” for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
      d. “N/A” for Not Applicable: By noting the term “not applicable” or “N/A” in the margin, it shall be understood that the specified item is not applicable to the project.

E. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.

F. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.

G. The Engineer will review all Shop Drawings submitted.

H. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:

1. “Reviewed” indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation. Shop drawings that are returned "Reviewed" or "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
2. “Furnished as Corrected” indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time. If the corrections are accepted by the contractor, shop drawings that are returned "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
3. “Revised and Resubmit” indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at their discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
4. “Rejected” indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.

I. If the Engineer rejects (Revised and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews. Contractor is responsible for all delays caused by the resubmittal process.

J. Should the contractor fail to comply with any of the requirements of the preceding sub-paragraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.

K. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

L. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.2 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.3 SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.4 MANUALS

A. In addition to catalog data and shop drawings submitted for review, this contractor shall furnish Systems Manuals (O&M's):
   1. The Contractor Shall provide an electronic copy in PDF format. The PDF shall contain:
      a. Approved Shop Drawings of all major components.
      b. Parts lists for the same components.
      c. Manufacturer's operating, maintenance, and cleaning instructions.
      d. List of materials recommended for maintenance.
      e. Factory startup reports.
      f. Valve tag list.
      g. Name and address of authorized service organization and parts depot.
      h. Chemical Treatment Analysis Reports for heating & cooling systems.
      i. Radiographic Testing Reports of welded pipe with picture of weld & location plan showing physical location of where test was performed.
      j. A description of how the components of a given HVAC system interact within the large system. For example, circulating pumps, boilers, unit heaters are part of the "heating system".
      k. A description of normal operating conditions for the system and its components.
      l. A description of common symptoms of a malfunctioning system and likely causes.
      m. Warranty letter from the automatic temperature controls contractor indicating the warranty period for their portion of the work.
      n. Signed owner instruction forms for all items specified as requiring owners' instruction.
   2. The Systems manual shall have an electronic index and be broken up by individual systems such as "heating", "shop exhaust", "kitchen ventilation and exhaust", "chilled water", "administration ventilation".
   3. Include at the front of the manual a complete listing of the Architect, Engineer and contractors and sub-contractors used on the project. Listing shall include names, addresses and phone numbers for each.

4. All major pieces of equipment shall be referenced with the equipment supplier's name, address and phone number shall be provided.
5. Where indicated in the Specifications, the Contractor shall provide the services of a factory trained representative to instruct the Owner's authorized personnel in the operation, control, and maintenance of equipment.

B. Operations and Maintenance Manuals shall be submitted to the Engineer for approval prior to delivery to the Architect.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 23 01 50 - MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 APPLICABILITY

A. This section covers basic materials and methods and applies to and forms a part of each of the sections of Division 23.

B. This work shall be in accordance with this and other applicable sections and/or provisions of these specifications and with the applicable drawings.

1.2 COORDINATION OF OPENINGS

A. This contractor shall coordinate all openings required for new piping, ductwork, equipment, controls, etc. through any structural slabs, beams, or walls. Contractor shall request a copy of the precast concrete shop drawings and verify locations and sizes of all openings required.

B. All costs associated with structural field changes or redesigns of the building systems due to lack of field coordination shall be responsibility of this contractor.

1.3 MATERIALS & MANUFACTURERS

A. All materials and equipment shall be new, free of defects, installed in accordance with manufacturer's current published recommendations in a neat manner and in accordance with standard practice of the industry.

B. Certain materials and/or equipment in this specification are specified by manufacturer and catalog numbers. The design was based on the specified equipment and establishes a degree of quality, performance, physical configuration, etc. If the contractor should elect to use equipment other than the equipment used as a basis for design but listed as "acceptable" in the specifications, he shall be responsible for space requirements, configuration, performance, and changes in bases, supports, vibration isolators, structural members, openings in structure and other apparatus that may be affected by its use.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS INSTALLATION

A. Piping is to be installed as shown on the drawings as much as practical. When a pipe size is not indicated, the subcontractor shall request the pipe size from the Architect through the Mechanical Contractor.

B. Provide sufficient swing joints, expansion loops, and/or devices necessary and install so as to permit free expansion and contraction of piping without causing undue stresses. Make all changes in direction with fittings. Support piping independently at all equipment so that its weight shall not be supported by the equipment.

C. Install piping without springing or forcing and clear all windows, doors, and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted.

D. All pipes shall be reamed to full pipe diameter before joining.

E. Install vertical risers plumb and straight, horizontal lines parallel with walls and partitions. Conceal piping above ceilings and within furring and/or walls (finished construction).

F. Provide shut-off valves and unions suitably located to isolate each item of equipment, branch circuit or section of piping.

G. Provide solid head plugs on any crosses, tees, etc., located in the piping around the boilers.

H. Provide drain valves at all low points of each system to enable complete drainage. Drain shall consist of a 3/4” ball valve with hose end.

I. Provide a manual air vent consisting of 1/2" ball valve with hose end installed on a "T" at all high points of each system to enable complete venting.

J. All piping shall be adequately supported from the building structure with adjustable hangers to maintain uniform grading where required and to prevent sagging or pocketing.

K. Provide supports between piping and building structure where necessary to prevent swaying.

L. The use of wire or perforated metal to support pipe will not be permitted.

2.2 SUPPORTING STEEL

A. Provide structural steel framework for supporting mechanical equipment as required.

B. All steel work shall be in conformance with the requirements of the AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings. Material shall conform to ASTM A36.

PART 3 EXECUTION

3.1 PROTECTION, DELIVERY AND STORAGE OF MATERIALS

A. Make provisions for the delivery and storage of materials and make the required arrangements with other contractors for the introduction into the building of equipment too large to pass through finished openings.

B. Protect materials and equipment stored on site from weather and moisture by maintaining factory covers and/or suitable weather-proof coverings. For extended outdoor storage, motors shall be removed from equipment and stored separately.

C. The open ends of all piping and ductwork shall be covered whenever that system is not being worked on, i.e., end of the workday, completion of a section, etc. Covering shall keep dust, garbage, vermin, and other foreign objects out of the piping or ductwork when the contractor is not on the jobsite.

3.2 CUTTING AND REPAIRING

A. All holes and penetrations required for the installation of the mechanical equipment shall be by the mechanical contractor. This shall include all piping, ductwork, and any other penetration through the wall, floor, or roof.

B. Cutting construction shall be done only with the written permission of the Architect. Cutting shall be done carefully and damage to buildings, pipes, wiring, or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional charge to the Owner. This Contractor shall be responsible for all cutting and patching unless such work has been delegated to the General Contractor.

C. All holes cut into concrete shall be cut by means of power saws or core drills. All unsightly spalls or chips shall be repaired.

D. All openings remaining around duct and pipe penetrations shall be filled, caulked, and painted to match wall. Code approved fire caulking shall be used for all rated penetrations.

3.3 SEALING FLOOR, CEILINGS AND WALL OPENINGS

A. Where pipes or ducts pass through walls, ceilings, floors, or partitions, (other than those through fire rated walls or chases) the opening in the construction around the pipe or duct shall not exceed ½ inch average clearance on all sides and shall be sealed to prevent the passage of sound and air. Coordinate wall openings to allow insulation thickness to pass through walls if allowed.

B. The material used to seal space between the wall and the pipe/duct shall be non-combustible caulk type, or wrap type, as conditions require. Provide sheet metal angles or flanges as may be required to contain the stopping material. Use of expanding foam will be allowed if surfaces are cleaned of an excess material and all edges are trimmed smooth. Penetrations through exterior walls shall be sealed weather tight.

C. Special attention shall be given to penetrations of mechanical room walls. Fill gaps around entire exterior area of the pipes or ducts with sound insulation (batt or mineral wool) to within ½” of the wall surface. Use silicone caulking to finish filling the opening smooth with the wall surface or provide sheet metal angles. All sealer shall meet flame spread 25 and smoke developed less than 50.

D. Where pipes or ducts pass through fire-rated walls, ceilings, floors, vertical service shafts walls, or partitions, the opening in the construction around the pipe or duct shall be fire-stopped to prevent the passage of flame and smoke. All assemblies shall be UL or ASTM listed to provide a fire rating equal to that of the construction being penetrated. For the firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests shall be submitted from the manufacturer to the local authorities having jurisdiction for their review and approval prior to installation. Individuals installing the firestopping shall be experienced and certified as required by the manufacturer whose product is being applied. Refer to firestopping specification section for more information.

E. Manufacturer’s assembly drawings shall be provided in O & M Manuals for each type of penetration. Printed metal or plastic labels shall be permanently applied on the structure within 6” of the edge of the firestop system. Metal labels shall be applied with mechanical fasteners & plastic labels shall be the self-adhering type with adhesive capable of permanently bonding labels to the surfaces on which the labels are placed. The information required on the label include UL/ASTM assembly number, date of installation, fire stopping material manufacture name, Contractor’s name, address & phone number & the installer’s name.

F. Duct coverings shall not extend through walls or floors required to be fire-stopped or have a fire resistance rating. Insulation shall be taped or sealed to the walls to eliminate sweating at any fire and/or smoke dampers.

G. Acceptable manufacturers shall be Hilti, 3M Brand, or a prior approved product.

3.4 CLEANING AND PAINTING

A. Clear away all debris, surplus materials, etc., resulting from work or operations, leaving the job and equipment furnished under this contract in a clean condition.

B. All exposed ductwork visible behind grilles, registers or air terminals shall be painted flat black.

C. All equipment being furnished with finished paint coat shall be examined upon job completion for scratches and other surface damage. All finished surfaces where necessary shall be touched up with touch-up paint of color to match the factory finish.

D. Paint all exposed bare pipe exterior of the building. Bare pipe shall be painted one coat of No. 7769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Final coat shall be of a color selected by the architect.

E. Paint all exposed iron and steel work, pipe hangers, pipe stands, uninsulated tanks, supporting steel for equipment and exposed bare pipe in mechanical areas. Iron and steel work and bare pipe shall be painted one coat of No. 4769402 damp-proof red primer as manufactured by Rust-Oleum Corporation, or equal, and one coat of oil paint. Iron and steel work shall be painted black.

3.5 ASBESTOS FREE BUILDING

A. There shall be no products or building materials used as a temporary or permanent element in the construction of this building, which has in its make-up any form of asbestos. The contractors shall be responsible to monitor shop drawings and product literature to verify the make-up of materials to be used in the building and remind material suppliers that their products must be asbestos free.

B. Notify the Architect immediately of any existing materials which are suspected of containing asbestos. Do not disturb or attempt to remove any asbestos containing material. The Architect will contact the Owner and inform them of the Contractors observations. The Owner will obtain and provide the services of professionals skilled in asbestos removal.

3.6 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

END OF SECTION

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.2 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

C. NEMA MG 00001 - Motors and Generators; 2024.

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

1.3 SUBMITTALS

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

B. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
1. Motors 3/4 HP and Smaller: 115 volts, single phase, 60 Hz.
2. Motors Larger than 3/4 Horsepower: Three phase, 60 Hz, motor voltage to be coordinated with electrical drawings.

B. 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 00001 limits for insulation class, service factor, and motor enclosure type.
4. All motors shall be premium efficiency type.

C. 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.

D. 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.

2.2 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Motors located in exterior locations: Totally enclosed type.

C. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

D. Motors located in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.3 SHAFT GROUNDING

A. All motors over 1 HP on variable frequency drives shall be equipped with shaft grounding system to discharge shaft voltage potential to ground. Motors on variable frequency drives shall be bonded from the motor foot to system ground with high frequency grounding strap consisting on tinned, copper strap with terminations to accommodate the motor foot and system ground.

2.4 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.5 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.6 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

D. Insulation System: NEMA Class B or better.

E. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

G. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

H. Sound Power Levels: To NEMA MG 00001.

I. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

J. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

K. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.7 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Electronically Commutated Motor
   1. Motor to be a DC electronic commutation type motor (ECM) specifically designed for application.
   2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
   3. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
   4. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.

PART 3 EXECUTION

3.1 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

SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

1.2 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

E. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - 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

2.1 PRESSURE GAUGES

A. 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.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.2 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.3 STEM TYPE THERMOMETERS

A. 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.
   1. Size: 9 inch scale.
   2. Window: Clear Lexan.
   3. Stem: 3/4 inch NPT brass.
   4. Accuracy: 2 percent, per ASTM E77.
   5. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.5 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.

2.6 STATIC PRESSURE GAUGES

A. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

B. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.1 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 pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.

E. 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.

F. Install thermometers in air duct systems on flanges.

G. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

H. Provide instruments with scale ranges selected according to service with largest appropriate scale.

I. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

J. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

K. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Globe valves.

B. Ball valves.

C. Butterfly valves.

D. Check valves.

E. Gate valves.

F. Chainwheels.

1.2 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

1.3 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

E. ASME B31.9 - Building Services Piping; 2020.

F. 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; 2023.

G. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

I. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).

J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

K. AWWA C606 - Grooved and Shouldered Joints; 2022.

L. MSS SP-67 - Butterfly Valves; 2022.

M. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.

N. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

O. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

1.4 SUBMITTALS

A. See Section 01 30 00 - 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.

1.5 QUALITY ASSURANCE

A. Manufacturer:
1. Obtain valves for each valve type from single manufacturer.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
a. Provide temporary inlet and outlet caps.

b. Maintain caps in place until installation.

2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:
1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable valve manufacturers are:
1. Apollo Valves
2. Milwaukee Valve
3. NIBCO
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
1. Throttling (Hydronic): Butterfly, Ball, and Globe.
2. Isolation (Shutoff): Butterfly, Gate, and Ball.
3. Swing Check (Pump Outlet):
   a. Size 2 inch and Smaller: Bronze with bronze disc.
   b. Size 2-1/2 inch and Larger: Iron with lever and weight or lever and spring.
4. Dead-End: Butterfly, single-flange (lug) type.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
   a. Size 2 inch and Smaller: Threaded ends.
   b. Size 2-1/2 inch and Larger: Grooved or flanged ends.
2. 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.

F. Chilled Water Valves:
1. Size 2 inch and Smaller, Bronze Valves:
   a. Threaded ends.
   b. Ball: Full port, two piece, stainless steel trim.
   c. Swing Check: Bronze disc, Class 125 .
   d. Globe: Bronze disc, Class 125.
2. Size 2-1/2 inch and Larger, Iron Valves:
   a. 2-1/2 inch to 4 inch: Flanged ends.
   b. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.

c. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
d. Swing Check: Metal seats, Class 125.
e. Swing Check with Closure Control: 2-1/2 inch to 12 inch, lever and spring, Class 125.
f. Grooved-End Check: 3 inch to 12 inch, 300 CWP.

G. Condenser Water Valves:
1. Size 2 inch and Smaller, Bronze Valves:
a. Threaded ends.
b. Ball: Full port, two piece, stainless steel 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: Flanged ends.
b. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
c. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
d. Swing Check: Metal seats, Class 125.
e. Swing Check with Closure Control, 2-1/2 inch to 12 inch: Lever and spring, Class 125.
f. Grooved-End Swing Check: 3 inch to 12 inch, 300 CWP.

H. Heating Hot Water Valves:
1. Size 2 inch and Smaller, Bronze Valves:
a. Threaded ends.
b. Ball: Full port, one piece, stainless steel 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: Flanged ends.
b. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
c. Grooved-End Butterfly: 2-1/2 inch to 12 inch, 175 CWP.
d. Swing Check: Metal seats, Class 125.
e. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure control, Class 125.
f. Grooved-End Swing Check: 3 inch to 12 inch, 300 CWP.

2.3 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. Gear Actuator: Quarter-turn valves 8 inch and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 inch and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

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.
2. Butterfly Valves: Extended neck.
3. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Press-Connect Connections: ASME
6. Grooved End Connections: AWWA C606.

G. General ASME Compliance:
1. Building Services Piping Valves: ASME B31.9.

2.4 BRONZE, GLOBE VALVES

A. CWP Rating: Class 125: 200 psi:
1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Stem and Disc: Bronze or PTFE.
5. Packing: Asbestos free.
6. Handwheel: Malleable iron.

2.5 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psi.
3. CWP Rating: 600 psi.
4. Body: Bronze.
5. End Connections: Pipe press, thread, or solder.
6. Seats: PTFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Ends: Threaded, Soldered, or Press.

2.6 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug Style; Bidirectional Dead-End Service without Use of Downstream Flange:
1. Comply with MSS SP-67, Type I.
2. Lug Style, CWP Ratings:
a. Sizes 2 to 12 inch: 150 psi.
b. Vacuum Service: Down to 29.9 in-Hg.
3. Body Material: ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: EPDM.
6. Disc: Aluminum Bronze or Stainless steel.

2.7 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 300 psi.

1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Two-piece stainless steel.
4. Disc: EPDM Encapsulated, ductile iron.
5. Disc Seal: EPDM.

2.8 BRONZE, LIFT CHECK VALVES

A. Class 125:
1. Comply with MSS SP-80, Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 250 psi.
3. Design: Vertical or horizontal flow.
4. Body: ASTM B61 or ASTM B62 Bronze.
5. Ends: Threaded, Soldered, or Press.
6. Disc (Type 2): NBR or PTFE.

2.9 BRONZE, SWING CHECK VALVES

A. Class 150:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. CWP Rating: 300 psi.
4. Body Design: Y-pattern, horizontal or vertical flow.
5. Body: ASTM B62 bronze.
6. End Connections: Threaded, Soldered, or Press.
7. Disc: Bronze or PTFE.

2.10 IRON, FLANGED END SWING CHECK VALVES

A. Class 125:
1. Comply with MSS SP-71, Type I.
2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
3. Body Design: Clear or full waterway.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Gasket: Asbestos free.

2.11 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125:
1. Comply with MSS SP-71, Type I.
2. Sizes 2-1/2 to 12 inch: CWP Rating; 200 psi.
3. Body Design: Clear or full waterway.
4. Body Material: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Gasket: Asbestos free.
8. Closer Control: Factory installed, exterior lever, and spring or weight.

2.12 IRON, GROOVED-END SWING CHECK VALVES

A. Class 250:
1. CWP Rating: 250 psi.
2. Body Material: ASTM A536, Grade 65-45-12 ductile iron.

3. Seal: EPDM.
4. Disc: Spring Operated, stainless steel with EPDM.

2.13 IRON, GATE VALVES

A. OS&Y:
1. Comply with MSS SP-70, Type I.
2. Class 125:
a. Sizes 2-1/2 to 12 inch, CWP Rating; 200 psi.
b. Sizes 14 to 24 inch, CWP Rating; 150 psi.
3. Body Material: ASTM A126 gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

2.14 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball, butterfly, and plug valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

PART 3 EXECUTION

3.1 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

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components.

1.2 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; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

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 (2022).

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 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

I. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. FM (AG) - FM Approval Guide; Current Edition.

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.

1.3 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 03 30 00.

1.4 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for 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.

PART 2 PRODUCTS

2.1 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. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
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. Prefabricated Trapeze-Framed Metal Strut Systems:
1. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
2. Strut Channel or Bracket 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. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. 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.

D. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

E. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch diameter.
b. Piping up to 1 inch: 1/4 inch diameter.
c. Piping larger than 1 inch: 3/8 inch diameter.
d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

F. 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.
3. Operating Temperatures from 122 to 446 degrees F:
a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

G. Roller Chairs:
1. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
2. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
3. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

H. Pipe Stanchions:
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

I. 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.

J. 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.

K. U-Bolts:
1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

L. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

M. Insulation Clamps:
1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

N. 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.
2. Clevis Hangers, Adjustable:
   a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
   b. Felt-Lined: MSS SP-58 Type 1, zinc-plated, silicone-free carbon steel.
   c. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
3. V-Bottom Clevis Hangers, Adjustable with Matching V-Channel:
   a. V-Bottom Clevis Hanger:
      1) MSS SP-58 galvanized, carbon steel.
   b. V-Channel
      1) Galvanized carbon steel.

O. Intermediate Pipe Guides:
1. Pipe Diameter 6 inch and Smaller: Provide minimum clearance of 0.16 inch.
2. Pipe Sizes 8 inch: 0.625 inch U-bolt with double nuts providing minimum clearance of 0.28 inch.
3. Pipe Size 10 inch: 0.75 inch U-bolt.
4. Pipe Sizes 12 to 16 inch: 0.875 inch U-bolt.
5. Pipe Sizes 18 to 30 inch: 1 inch U-bolt.
6. Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

P. Pipe Alignment Guides: Galvanized steel.
1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.

2. Pipe Sizes 10 inch and Larger: Roller type.

Q. 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.

R. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

S. Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Minimum Service Temperature: Minus 40 degrees F.
e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

T. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

U. Rooftop Condensate Supports:
1. Manufacturers:
a. Mifab, CE10 Extension Series.
b. B-Line.
2. General:
a. Base Material - 100% recycled rubber.
b. Base Dimensions - 4" Height x 6" width x 9.6" Length.
c. Strut - 14 gauge galvanized steel. Where disimmilar metals are in contact, provide rubber pipe isolators.
d. Rod - Two 1/2" electro zinc lated all threaded rod risers, height as requried to slope piping to discharge location.

PART 3 EXECUTION

3.1 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. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, 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. 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

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.4 SUBMITTALS

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

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Terminal Units: Nameplate and Ceiling tacks where located above ceilings.

B. Heat Pumps and Fan-Coil Units: Nameplate and Ceiling tacks where located above ceilings.

C. Exhaust and Air Transfer Fans: Nameplate and Ceiling tacks where located above ceilings.

D. Control Panels: Nameplates.

E. Heat Pumps and Fan-Coil Units: Nameplate and Ceiling tags where located above ceilings.

F. Heat Transfer Equipment: Nameplates.

G. Piping: Adhesive-backed duct markers.

H. Pumps: Nameplates.

I. Tanks: Nameplates.

J. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch.

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.3 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.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: Yellow/Black.

2.5 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
1. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
2. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
3. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
4. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
5. Ductwork and Equipment: 2-1/2 inch high letters.

B. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors complying with ASME A13.1.

2.6 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

D. Ammonia Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

2.7 CEILING TACKS

A. Description: Adhesive backed 3/4 inch diameter sticker, color coded.

B. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply ASME A13.1 Pipe Marking Rules:
1. Place pipe marker adjacent to changes in direction.
2. Place pipe marker adjacent each valve port and flange end.
3. Place pipe marker at both sides of floor and wall penetrations.
4. Place pipe marker every 25 to 50 feet interval of straight run.

D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

E. Place Ceiling Tacks on ceiling grid at locations of all above ceiling equipment, terminal boxes, valves, etc.

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 23 08 00 - Commissioning of HVAC.

1.2 REFERENCE STANDARDS

A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

1.3 SUBMITTALS

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

B. 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. Submit to the Commissioning Authority.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. 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. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to the Commissioning Authority.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. 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 both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

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.

3.2 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

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. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. 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.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. 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.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

O. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.3 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. 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.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. 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.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.4 COMMISSIONING

A. See Sections 01 91 13 - General Commissioning Requirements and 23 08 00 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
1. Air side systems.
2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for ___ percent of the air handlers plus a random sample equivalent to ____ percent of the final TAB report data as directed by Commissioning Authority.
1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:
   a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.

b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
c. Temperatures: Deviation of more than one degree F.
d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.5 SCOPE

A. Test, adjust, and balance the following:
1. Plumbing Pumps.
2. HVAC Pumps.
3. Chillers.
4. Cooling Towers.
5. Packaged Roof Top Heating/Cooling Units.
6. Air Coils.
7. Air Handling Units.
8. Fans.
9. Air Terminal Units.
10. Air Inlets and Outlets.

3.6 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.
7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Chillers:
1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.
10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

E. Cooling Tower:
1. Tower identification/number.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Rated capacity.
6. Condenser water entering temperature.
7. Condenser water leaving temperature.
8. Condenser water flow rate.
9. Fan RPM.

F. Heat Exchangers:
1. Identification/number.
2. Service.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Primary water entering temperature, design and actual.
7. Primary water leaving temperature, design and actual.
8. Primary water flow, design and actual.

9. Primary water pressure drop, design and actual.
10. Secondary water leaving temperature, design and actual.
11. Secondary water flow, design and actual.
12. Secondary water pressure drop, design and actual.

G. Cooling Coils:
1. Identification/number.
2. Service.
3. Air flow, design and actual.
4. Water flow, design and actual.
5. Water pressure drop, design and actual.
6. Entering water temperature, design and actual.
7. Leaving water temperature, design and actual.
8. Air pressure drop, design and actual.

H. Heating Coils:
1. Identification/number.
2. Service.
3. Manufacturer.
4. Air flow, design and actual.
5. Water flow, design and actual.
6. Entering water temperature, design and actual.
7. Air pressure drop, design and actual.

I. Electric Duct Heaters:
1. Identification/number.
2. Model number.
3. Design kW.
4. Number of stages.
5. Phase, voltage, amperage.
6. Test voltage (each phase).
7. Test amperage (each phase).
8. Air flow, specified and actual.

J. Air Moving Equipment:
1. Manufacturer.
2. Model number.
3. Serial number.
4. Arrangement/Class/Discharge.
5. Air flow, specified and actual.
6. Return air flow, specified and actual.
7. Outside air flow, specified and actual.
8. Total static pressure (total external), specified and actual.
9. Inlet pressure.
10. Discharge pressure.
11. Sheave Make/Size/Bore.
12. Number of Belts/Make/Size.
13. Fan RPM.

K. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.

6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.

L. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test static pressure.
7. Test orifice differential pressure.
8. Leakage.

M. Air Monitoring Stations:
1. Identification/location.
2. System.
3. Size.
4. Area.
5. Design velocity.
6. Design air flow.
7. Test velocity.
8. Test air flow.

N. Flow Measuring Stations:
1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Design Flow rate.
8. Design pressure drop.
9. Actual/final pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

O. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Model number.
5. Size.
6. Minimum static pressure.
7. Minimum design air flow.
8. Maximum design air flow.
9. Maximum actual air flow.
10. Inlet static pressure.

P. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.

5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Weather barrier coatings.

D. Jacketing and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

C. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).

F. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).

G. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

H. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

L. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

N. UL 181A - Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

O. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

P. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - 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 necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 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.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
2. Johns Manville; _____: www.jm.com/#sle.
3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
4. Knauf Insulation: www.knaufinsulation.com/#sle.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Indoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.3 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
2. Johns Manville; _____: www.jm.com/#sle.
3. Knauf Insulation; _____: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.4 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.
3. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
4. Color: As selected by Architect.

2.5 JACKETING AND ACCESSORIES

A. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.
1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
2. Thickness: 34 mil, 0.034 inch.
3. Finish: Embossed.
4. Color: Silver.

5. Water Vapor Transmission: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
6. Mold Resistance: Pass when tested in accordance with ASTM C1338.
7. Emissivity: 0.30 when tested in accordance with ASTM C1371.

B. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.

C. Plain Foil Tape:
1. Aluminum foil with pressure-sensitive adhesive on paper release liner.

D. UL181 Tape for Rigid and Flexible Ductwork:
1. Comply with UL 181A for rigid ductwork.
2. Comply with UL 181B for flexible ductwork.
3. Aluminum foil coated with pressure-sensitive adhesive on paper release liner.
4. Foil tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.

2.6 DUCT LINER

A. Note: Choose the liner type - Elastomeric Foam, Glass Fiber, or Phenolic Foam.

B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
1. Fungal Resistance: No growth when tested according to ASTM G21.
2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

D. Slope exterior ductwork to shed water.

E. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:

B. Outside Air Intake Ducts:

C. Supply Ducts:

D. Supply Ducts From Fans to Vertical Ducts in Shafts (Cooling System):

E. Supply Ducts in Vertical Shafts (Cooling Systems):

F. Ducts Exposed to Outdoors:

END OF SECTION

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 2 PRODUCTS

1.1 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.

1.2 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
2. Johns Manville Corporation; _____: www.jm.com/#sle.
3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation; _____: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.

C. Vapor Barrier Jacket:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with self-sealing longitudinal laps and butt strips.
4. Secure with outward clinch expanding staples and vapor barrier mastic.

D. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

1.3 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

2.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Insulated equipment containing fluids below ambient temperature; insulate entire system.

D. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

E. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

F. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

G. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

H. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

2.2 SCHEDULE

A. Heating Systems:
1. Heat Exchangers/Converters:
2. Air Separators:

B. Cooling Systems:
1. Pump Bodies:
2. Air Separators:
3. Expansion Tanks:
4. Chiller Cold Surfaces (Not Factory Insulated):
5. Cold Thermal Storage Tanks:

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

I. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

J. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

K. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

L. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2019).

M. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

N. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics; 2017 (Reapproved 2023).

O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

P. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

Q. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

R. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

S. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

T. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

U. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.1 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.

2.2 GLASS FIBER, RIGID

A. 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.

B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

F. Insulating Cement: ASTM C449.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA, Inc; AEROFLEX Self-Seal: 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.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.4 RIGID, CELLULAR PHENOLIC

A. Manufacturers:
1. Dyplast Products, LLC; _____: www.dyplastproducts.com/#sle.
2. ITW Insulation Systems; _____: www.itwinsulation.com/#sle.
3. Polyguard Products; PolyPhen: www.polyguardproducts.com.com/#sle.

B. Insulation: ASTM C1126, Type III, Grade 1.
1. Nominal Density: 3.75 pcf.
2. Preliminary Initial Minimum K Value: 0.145 at 50 degrees F based on density of 2.5 pcf.
3. Maximum Service Temperature: 248 degrees F.
4. Minimum Service Temperature: Minus 292 degrees F.
5. Minimum compressive strength as determined by ASTM D1621.
6. Minimum tensile strength as determined by ASTM D1623.

2.5 JACKETING AND ACCESSORIES

A. ABS Plastic:
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: Minus 40 degrees F.
b. Maximum Service Temperature: 180 degrees F.
c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
d. Thickness: 30 mil, 0.030 inch.
e. Connections: Brush on welding adhesive.

B. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Type: Factory-applied, self-adhesive jacketing.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

C. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723, ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.

2.6 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
1. Wall Outlet Size, Stucco and Masonry Applications: 7-1/2 inch wide by 10 inch high.
a. Elastomeric Sleeve Diameter: 1-11/16 inch.
2. Outlet Cover Color: Gray.

3. Water Penetration: Comply with ASTM E331.
4. Air Leakage: Comply with ASTM E283.
5. Air Permeance: Comply with ASTM E2178.

B. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
1. PVC Insulation Cover Color: Black with full-length velcro fastener.
2. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

2.7 ACCESSORIES

A. General Requirements:
1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
4. 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

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

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:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

G. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

H. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.2 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return: 2 inch, Fiber Glass, Ridged

B. Cooling Systems:
   1. Chilled Water: 2 inch, Cellular Phenolic, Rigid

C. Other Systems:
   1. Piping Exposed to Freezing with Heat Tracing:

END OF SECTION

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 RELATED WORK

A. Division 22 - Plumbing

B. Division 26 - Electrical

1.2 REFERENCES

A. Drawings and general provisions of contract, including general and supplementary conditions, general mechanical provisions and Division-1 Specification sections, apply to work of this section.

B. ASHRAE Guideline 1-1996

C. ASHRAE Guideline 0-2005

D. ACG Commissioning Guideline – 2005

1.3 DESCRIPTION OF WORK

A. The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the mechanical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers.

B. The independent commissioning agent (CA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 ROLES OF THE COMMISSIONING AGENCY

A. The primary point of responsibility is to inform the construction manager, the owner and design team on the status, integration, and performance of HVAC systems within the facility.

B. The CA shall function as a catalyst and initiator to disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification and functional performance testing, and documenting proper distribution of performance and operating information to the owner's O&M staff.

C. Assist the responsible parties to maintain a high quality level of installation by meeting or exceeding prevailing standards and specifications.

D. The CA shall observe and coordinate testing as required to assure system performance meets the design intent.

E. The CA shall document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded.

F. The CA shall provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.

G. The CA is to remain an independent party with specific knowledge of the project. The CA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CA shall monitor resolution for conformance with design intent and prevailing industry standards.

H. The CA shall document the date of acceptance as determined by the construction manager, owner and design team. System Verification Checklists and Functional Performance Test results may be used in determining the start of the warranty period for HVAC systems and subsystems.

I. The CA will review operating and maintenance materials for HVAC systems.

J. The CA will review phasing plans as provided by the GC relating to temporary use of HVAC equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

3.2 SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS

A. HVAC System
1. Chillers
2. Pumps
3. Boilers
4. Cooling Towers
5. Variable Frequency Drives
6. Air Handling Units
7. Energy Recovery Units
8. VAV boxes
9. Supply and Exhaust Fans

B. DDC Controls

C. DDC System GUI Compliance

D. Domestic Hot Water System

E. Science Lab Safety Panels

F. Lighting Controls

G. Electric Sub-Metering

3.3 HVAC COMMISSIONING PLAN

A. Commissioning Team
1. The Commissioning Team (CT) shall consist of key parties involved in design, construction and testing of this facility. It is necessary for each agency to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each of the parties listed below:
   a. Program Manager (PrM)
   b. Facilities Management Division (FMD)
   c. Commissioning Agent (CA)
   d. Design Team (DT)
   e. General Contractor (GC)
   f. GC's Mechanical Contractor (MC)
   g. GC's Controls Contractor (CC)
   h. Test and Balance Contractor (TABC)
   i. GC's Electrical Contractor (EC)

B. Basis of Design Document
1. The Basis of Design Document (BOD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BOD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.
2. The CA will review the BOD documents for adequate commissioning provisions, functional performance, optimization of performance, accessibility, TAB provisions, and O&M considerations.

C. Commissioning Meetings
1. Commissioning meetings will be held in conjunction with progress meetings as necessary. Commissioning meetings will be used to address any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users and owners.

D. Resolution Tracking Forms (RTF)
1. The use of Resolution Tracking Forms is a method employed by the CA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
2. The CA will regularly submit RTF’s to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

E. System Verification Checklists (SVC) / Manufacturers’ Checklists

1. The MC will provide SVC's based on manufacturers start-up procedures. These tests should be provided for all systems and subsystems. See SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS. Draft copies will be submitted to the CT for review and comment prior to placement on the job site. A master copy of the SVC's will be bound in a three-ring binder and placed on the job site for use by the installing contractors. No system will be started until the appropriate SVC's have been completed.
2. The CA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CA.
3. The equipment manufacturers' checklists must also be reviewed by the CA prior to start-up. These lists must be completed by the installing contractor, and reviewed by the CA before start-up can commence.

F. Start-Up
1. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate SVC's have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The CA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting HVAC equipment.
2. CT members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-authorized technician will be on site to start equipment when required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the BoD.

G. Controls Monitoring
1. Close monitoring of the Control Contractor's progress will promote efficient coordination of the TAB work. The CC will be expected to submit point-to-point checklists verifying that his work has been completed and all systems are ready for TAB work and Functional Performance Testing. Programming and graphics will be surveyed by the CA for completeness and conformance with the BoD and the owner's scheduling requirements.

H. TAB Monitoring
1. The preliminary TAB report set-up will be reviewed prior to HVAC equipment start-up, in order to assure that the final TAB report format and content is acceptable.
2. TAB work will be monitored so that any problems that prevent or hinder proper air and water balance can be addressed and corrected with minimal delays. By addressing these problems as quickly as possible, we can assure that functional performance testing and owner training will take place on schedule.
3. A pencil copy of the TAB report will be reviewed prior to submission of the final TAB report. A written review will be submitted to the TAB contractor and to the DT for their comments. A TAB report approved by the DT will be required before Functional Performance Testing can be carried out. The CA will visit the site during the TAB process in order to assist TABC and CC in the effective completion of their scope of work.

I. Functional Performance Tests (FPT)
1. The CA will write FPT's based on the respective sequence of operations. These tests will be created for systems and subsystems. See SYSTEMS INCLUDED IN THE COMMISSIONING PROCESS above.

2. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CA and the owner's maintenance staff. Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, the TAB report has been submitted and reviewed, and the completion of the control system has been documented through point-to-point checklists and other documentation.
3. The Functional Performance Tests shall include HVAC and related equipment.
    a. AHU's will be tested in designed operating modes. Proper operation will be verified at minimum OA, maximum OA, automatic control, and other modes, if necessary, to achieve BOD conformance.
    b. Variable Air Volume terminals with and without reheats will be tested at minimum and maximum temperature set points, and under automatic control. Intermediate settings will be tested as necessary.
    c. Chilled water system will be tested in designed operating modes. Proper operation will be verified at minimum loads, maximum loads, waterside economizing mode, Manual control, automatic control, and other modes.
    d. Hot water system will be tested.
    e. EF's will be tested for conformance to BoD.
    f. Hydronic pumps will be tested under relevant operating conditions.
    g. Heat Exchangers will be tested under relevant operating conditions.
    h. DDC control systems will be tested as necessary.
    i. HVAC systems will be tested to assure that the building as an integrated system operates properly.
    j. Trend verification of systems and subsystems shall be completed prior to start of functional performance testing. CA will provide trend format to CC and discuss trend requirements in CX meetings throughout the construction phase of project.
4. Deferred Testing
    a. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by the appropriate parties and test rescheduled.
    b. Off-season mode testing will be implemented as necessary to assure conformance with the BoD. Installing contractors will be expected to participate as required by the project specifications.
5. Rescheduled Functional Performance Test
    a. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, their time will be billed to the contractor as an additional fee of $1500.00 per day.
    b. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed at a rate of $1500.00 per day for the commissioning personnel's return trip.

J. Building Turn-Over / Owner Orientation / User Training
1. The CA will oversee contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.
2. The CA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.
3. Owner training will be coordinated with the assistance of the CA. The training will be provided by the installing contractor, or manufacturer's representative, and witnessed by the CA. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The CA will visit the site during the Turn-Over and Training period to assure that any on-going HVAC related problems are being addressed and corrected in a timely and efficient manner.

4. The CA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

3.4 RESPONSIBILITIES OF TEAM MEMBERS

A. General Contractor (GC)
1. Include commissioning requirements in the mechanical, electrical, and controls contracts, as well as other subcontracts, to assure full cooperation of all parties in the Plumbing commissioning process.
2. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the mechanical commissioning program as described in the contract documents.
3. Assure that the CA shall receive a copy of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
4. Coordinate inclusion of commissioning activities in the construction schedule.
5. Facilitate resolution of deficiencies identified by observation or performance testing.
6. Assist the CA in monitoring the duct leakage testing.

B. GC's Mechanical Contractor (MC)
1. Each contractor in this division shall include in their quote the cost of participating in the commissioning process.
2. Include requirements for submittal data (including partial load data), O&M data, and training in each purchase order or sub-contract.
3. Assure cooperation and participation of specialty sub-contractors such as sheet metal, piping, refrigeration, water treatment, temperature controls, and TAB in commissioning activities.
4. Assure participation of major equipment manufacturers in appropriate startup, training, and testing activities.
5. Attend commissioning meetings scheduled by the CA.
6. Assist the CA in system verification and performance testing.
7. Prepare preliminary schedule for HVAC system inspections, O & M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, system verification, performance testing, and system completion for use by the CA. Update schedule as appropriate throughout the construction period.
8. Complete System Verification Checklists and manufacturer’s pre-start checklists prior to scheduling startup of HVAC equipment.
9. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
10. Notify the CA a minimum of two weeks in advance of scheduled system start-up.
11. Update drawings to as-built condition and review with the CA throughout the construction process.
12. Schedule vendor and subcontractor provided training sessions as required by project specifications.
13. Provide written notification that the following work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent.
    a. HVAC equipment including fans, air handling units, dehumidification units, ductwork, dampers, terminal devices, etc.
    b. Fire detection and smoke detection devices furnished under other divisions as they affect the operation of the HVAC systems.
    c. That BAS is functioning in accordance with design intent.
14. Participate in the Functional Performance Tests.
15. Participate in the off-season mode testing.
16. Participate in O&M Training as required by project specifications.

17. Provide a complete set of as-built drawings and O & M manuals for review. The CA shall review the as-built drawings and O&M manuals concurrently with the design team.

C. Test and Balance Contractor (TABC)
1. Include cost for commissioning requirements (participation) in the contract price.
2. Attend commissioning meetings scheduled by the CA.
3. Submit the TAB procedures and preliminary TAB report to the CA for review at least two weeks prior to beginning TAB work.
4. Notify the CA a minimum of two weeks in advance of scheduled TAB work.
5. Provide partial, preliminary TAB Reports by phase, by building section, by system, or as required by the CA.
6. Assist the CA in system verification and performance testing.
7. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
8. Participate in verification of the TAB report, which will consist of repeating any selected measurement contained in the TAB report where required by the CA for verification or diagnostic purposes.
9. Participate in the Functional Performance Tests as required to achieve design intent.
10. Provide sound and vibration where required to assist in diagnosis of areas exhibiting unacceptable levels of noise or vibration.
11. Participate in the off-season mode testing as required to achieve design intent.
12. Participate in O&M Training as required by project specifications.

D. GC's Temperature Control Contractor (TCC)
1. Include cost for commissioning requirements in the contract price.
2. Review control sequence and component selection for conformance with design intent.
   a. Attend a submittal review meeting with the CA and Engineer to ensure clear understanding of scope of work and expectations.
   b. Verify that specified safeties and interlocks have been selected.
   c. Verify proper selection of control valves and actuators based on design parameters.
   d. Verify proper selection of control dampers and actuators based on design parameters.
   e. Verify that sensor selection conforms to design intent.
3. Attend commissioning meetings scheduled by the CA.
4. Provide the following submittals to the CA:
   a. Hardware and software submittals.
   b. Control panel construction shop drawings.
   c. Narrative description of control sequences for each HVAC system and subsystem.
   d. Schematics showing all control points, sensor locations, point names, actuators, controllers and where necessary, points of access.
   e. A list of all control points, including analog inputs, analog outputs, digital inputs and digital outputs. Include the values of all parameters for each system point. Provide a separate list for each stand-alone control unit.
   f. A complete listing of all software routines employed in operating the control system. Also provide a program narrative that describes the logic flow of the software and the functions of each routine and sub-routine. The narrative should also explain individual math or logic operations that are not clear from reading the software listing.
   g. Hardware operation and maintenance manuals.
   h. Application software and project applications code manuals.
   i. Panel and equipment insert documents.
   j. Assist CA with remote monitoring capabilities. Supply any software and/or hardware needed.
5. Verify that specified interfaces provided by others are compatible with BAS hardware and software.

6. Coordinate installation and programming of BAS with construction and commissioning schedules.
7. Complete System Verification Checklists and manufacturer's pre-start checklists prior to scheduling startup of HVAC equipment.
8. Provide control system technician to assist during equipment startup.
9. Monitor and respond to Resolution Tracking Forms distributed by the CA in order to expedite corrective actions necessary to achieve design intent.
10. Participate in the Functional Performance Tests as required by the project specifications.
11. Provide a control system technician to assist during verification and performance testing.
12. Provide system modifications to achieve system operation as defined by the design intent.
13. Provide support and coordination for TAB contractor. Provide all devices, such as portable operator terminals and all software for the TAB to use in completing TAB procedures.
14. Provide written notification that the TCC scope of work has been completed in accordance with the project specifications, and that the equipment, systems and sub-systems are operating in accordance with design intent, and that BAS is functioning in accordance with design intent.
15. Participate in the Functional Performance Tests as required to achieve design intent.
16. Participate in the off-season mode testing as required to achieve design intent.
17. Participate in O&M Training as required by project specifications. Include training on hardware operations and programming

END OF SECTION

SECTION 23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 GENERAL

1.1 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:
   1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
   2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
   3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
   4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
   5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
   6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
   7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
   8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
      a. Water Temperature: Plus or minus 1 deg F.
      b. Water Flow: Plus or minus 5 percent of full scale.
      c. Water Pressure: Plus or minus 2 percent of full scale.
      d. Space Temperature: Plus or minus 1 deg F.
      e. Ducted Air Temperature: Plus or minus 1 deg F.
      f. Outside Air Temperature: Plus or minus 2 deg F.
      g. Dew Point Temperature: Plus or minus 3 deg F.
      h. Temperature Differential: Plus or minus 0.25 deg F.
      i. Relative Humidity: Plus or minus 5 percent.
      j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
      k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
      l. Airflow (Terminal): Plus or minus 10 percent of full scale.
      m. Air Pressure (Space): Plus or minus 0.01-inch wg.
      n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
      o. Carbon Monoxide: Plus or minus 5 percent of reading.
      p. Carbon Dioxide: Plus or minus 50 ppm.
      q. Electrical: Plus or minus 5 percent of reading.

1.2 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
   2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.

3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including flow characteristics.
7. DDC System Hardware:
   a. Wiring diagrams for control units with termination numbers.
   b. Schematic diagrams for field sensors and control hardware.
   c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
8. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
9. Controlled Systems:
   a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
   c. Written description of sequence of operation including schematic diagram.
   d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

F. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with ASHRAE 135 for DDC system components.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.5 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

C. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.

D. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

PART 2 PRODUCTS

2.1 CONTROL SYSTEM

A. Available Manufacturers:
1. Alerton as installed by Climatec
2. Reliable Controls as installed by Unified Energy Solutions
3. Automated Logic Corporation as installed by local factory ALC Branch

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network through a standard web broswer via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.2 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
      d. Software applications, scheduling, and alarm processing.
      e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
   3. Standard Application Programs:
      a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
      b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
      c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
      d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
      e. Remote communications.
      f. Maintenance management.
      g. Units of Measure: Inch-pound and SI (metric).
   4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

B. Diagnostic Terminal Unit: The control contractor to include $1,000 allowance in the bid for purchase of the diagnostic terminal unit.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
   3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation Not standard
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mAnot standard
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.3 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 4-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.4 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F, and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

D. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.
1. Remote-control-point adjustment shall be plus or minus 20 percent of sensor span, input signal of 3 to 13 psig.
2. Proportional band shall extend from 2 to 20 percent for 5 psig.
3. Authority shall be 20 to 200 percent.
4. Gages: 2-1/2 inches in diameter, 2.5 percent wide-scale accuracy, and range to match transmitter input or output pressure.

2.5 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Space Temperature Sensor (Thermostat):
1. Thermistor with resistance of 10,000 ohms at 77□F.
2. Accuracy shall be +/-1/2□F.
3. Range of 55□ to 95□ F.
4. Provide manufacturers calibration certificate.
5. Front covers without displays throughout the building.
6. Temperature Indicator:
   a. Offices: Numeric LED
   b. Classrooms: None
   c. Public Areas: None
7. Setpoint Adjustment:
   a. Offices: Push Button
   b. Classrooms: None
   c. Public Areas: None
8. Occupant Override:
   a. Offices: Push Button
   b. Classrooms: None
   c. Public Areas: None
9. Ventilation ring for fast response
10. Jack at sensor for communications
11. Location and height to be approved by Engineer prior to installation
12. Color to be approved by Engineer/Owner. Submit a sample to reviewed by owner. Acceptance of sample shall be in writing to contractor.
13. Provide ventilated locking clear plastic guards in the following locations:
   a. Cafeteria
   b. Kitchen/Serving Lines
   c. Gymnasium
   d. Dressing/Locker Rooms/Weight Rooms
   e. Industrial Labs
14. Provide an insulated sensor wall plate to fully cover wall opening. Back cover plate shall match sensor color.
15. Where indicated on drawings to provide both space temperature and space humidity, a combination temperature sensor shall be provided.

C. Thermistor Temperature Sensors and Transmitters:
1. Accuracy: Plus or minus 0.5 deg F at calibration point.

2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
4. Averaging Elements in Ducts: 36 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft.
5. Averaging Elements at coils: Flexible type serpentine across the entire face of the coil, (minimum of 2-passes).
6. Freeze Stats: Flexible type serpentine across the entire face of the coil every six inches on center.
7. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

D. Outside Air Temperature and Humidity Sensor:
1. Temperature
   a. Range of –40□ to 140□F.
   b. Accuracy shall be +/-0.9□F
   c. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.
2. Humidity
   a. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
   b. Accuracy shall be +/-2%
   c. Range from 20 to 95% RH.
   d. Relative humidity sensors shall have the sensing element of inorganic resistance media.
3. Weatherproof sun shield consisting of multiple white plastic plates to reduce the thermal effects of the sum and increasing air flow between the plates.
4. Sensor shall be mounted a minimum of 6” from all building structures.
5. Minimum of 8' long leads.
6. Provide manufacturers calibration certificate.
7. Provide with a 5-year warranty

E. Humidity Sensors: Bulk polymer sensor element.
1. Accuracy: 2 percent full range with linear output.
2. Room Sensor Range: 20 to 80 percent relative humidity.
3. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
4. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F
5. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

F. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

G. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

H. Pressure Transmitters/Transducers:

1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg.
   d. Duct Static-Pressure Range: 0- to 5-inch wg.
2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

2.6 STATUS SENSORS

A. Status Inputs for Fans: Current Switches. See below for requirements. Provide a current switch on each fan motors with a multiple fan AHU.

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig, piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches:
   1. Ensure compatibility with VFD applications for variable speed motor status.
   2. Provide with adjustable set point.
   3. Relays must be mounted and not hung by power wires thru CT.
   4. Provide split-core type.
   5. Loop powered.
   6. LED Status.
   7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.

G. Current Transducers:
   1. Ensure compatibility with VFD and ECM applications for variable speed motor status and current.
   2. Provide with adjustable set point capable of reading lowest required amperage.
   3. The current sensor shall be a split core type with self-gripping iris that adheres to the electrical conductor.
   4. Provide split-core type.
   5. Loop powered.
   6. The current sensor shall be fixed 0-10A and output of 0-10 VDC.
   7. LED Status.

8. Transducer shall provide a current reading to BMCS.

H. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

I. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.7 FLOW MEASURING STATIONS

A. Electromagnetic Flow Meters:
1. Retractable hot tap flow sensor
2. Accuracy: +/- 1% of full scale
3. Custom thread-o-let 400 psi / 250°F rated
4. Installed into a 1” full port ball valve
5. Provided with an insertion depth gage
6. Line size from 2-1/2 to 72 inches
7. Metering range from 0.1 to 20 f/sec (200:1 turndown).
8. Remote NEMA 4 wall mounted LCD display. Mounted on wall at 5’-6” above finished floor.
9. Field Pro Software & Communicator
10. Warranty two years
11. Approved Manufacturer: Onicon Electromagnetic Flow Meter F-3500 Series

2.8 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
2. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
   e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.

f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Two-Position Spring Return): -V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F .
10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
11. Run Time: 12 seconds open, 5 seconds closed.

2.9 CONTROL VALVES

A. Ball Valves with Characterized Disk and Threaded Ends.
1. Source Limitations: Obtain two-way ball valves, with characterized disk and threaded ends, from single manufacturer.
2. Performance:
   a. Stem Action: Rotary, 0 to 90 degrees.
   b. Controllable Flow Range: 75 percent open.
   c. Flow Characteristic: Equal percentage.
   d. Leakage: Zero percent.
   e. Hydronic Pressure:
      1) Rating: Nominal 400 psig.
      2) Close-off Pressure: 200 psig.
      3) Pressure Differential (Maximum): 50 psig.
3. Construction:
   a. Size Range: NPS 1/2 to NPS 2.
   b. Body: Cast bronze or forged brass with nickel plating.
   c. End Connections: Female threaded (NPT) ends.
   d. Ball: 300 series stainless steel.
   e. Ball Seats: Reinforced PTFE.
   f. Characterizing Disk: Stainless steel.
   g. Stem and Stem Extension:
      1) Material to match ball.
      2) Blowout-proof design.
      3) For valves installed in insulated piping systems, provide stem extension.
      4) Provide sleeve or other approved means to allow valve to be opened and closed without damaging the insulation and the insulation vapor barrier seal.
   h. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.

B. Ball Valves with Characterized Disk and Flanged Ends, Two Way:
1. Source Limitations: Obtain two-way ball valves, with characterized disk and flanged ends, from single manufacturer.
2. Performance:
   a. Stem Action: Rotary, 0 to 90 degrees.
   b. Controllable Flow Range: 75 percent open.
   c. Flow Characteristic: Equal percentage.
   d. Leakage: Zero percent.
   e. Hydronic Pressure:

1) Rating: In accordance with ASME B16.1, Class B.
2) Close-off Pressure:
(a) Class 125: 175 psig.
3) Pressure Differential (Maximum): 50 psig.

3. Construction:
a. Size Range: NPS 2-1/2 to NPS 6.
b. Body: Cast iron, Class B in accordance with ASME B16.1.
c. End Connections: Flanged, Class 125 or 250 in accordance with ASME B16.1.
d. Ball: Stainless steel.
e. Ball Seats: Reinforced PTFE.
f. Characterizing Disk: Stainless steel.
g. Stem and Stem Extension: Material to match ball; blowout-proof design.
h. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.

C. Ball Valves with Characterized Disk and Threaded Ends, Three Way:
1. Source Limitations: Obtain three-way ball valves, with characterized disk and threaded ends, from single manufacturer.
2. Performance:
a. Stem Action: Rotary, 0 to 90 degrees.
b. Controllable Flow Range: 75 percent open.
c. Flow Characteristics:
1) A-Port: Equal percentage.
2) B-Port: Modified for constant common port flow.
d. Leakage: Zero percent for A-port; two percent for B-port.
e. Hydronic Pressure:
1) Rating: Nominal 400 psig.
2) Close-off Pressure: 200 psig.
3) Pressure Differential (Maximum): 50 psig.
3. Construction:
a. Size Range: NPS 1/2 to NPS 2.
b. Body: Cast bronze or forged brass with nickel plating.
c. End Connections: Female threaded (NPT) ends.
d. Ball: 300 series stainless steel.
e. Ball Seats: Reinforced PTFE.
f. Characterizing Disk: Stainless steel.
g. Stem and Stem Extension:
1) Material to match ball.
2) Blowout-proof design.
3) For valves installed in insulated piping systems, provide stem extension.
4) Provide sleeve or other approved means to allow valve to be opened and closed without damaging the insulation and the insulation vapor barrier seal.
h. Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.

D. Vave Sizing: By Automatic Control System Manufacturer for fully modulating operation.
1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
2. Maximum pressure drop: 5 psi.
3. Relief and bypass valves: Sized according to pressure available.
4. 2-position valves: Line size.
5. Manual by-pass operator.

2.10 CONTROL DAMPERS

A. Model: Ruskin CD50 or equal.

B. Rating:
1. Leakage Rating: Class 1A.
2. Temperature Rating: Withstand -22 to 122 degrees F.
3. Capacity: Damper shall withstand system operating conditions
4. Closed Position: Maximum pressure of 13 inches w.g. @ a 12 inches blade length.
5. Open Position: Maximum air velocity of 6,000 feet per minute.
6. Pressure Drop: Maximum 0.03-inch w.g. at 1,500 feet per minute across 24 inch x 24 inch damper.

C. Construction:
1. Frame: 5 inches x 1 inch x minimum 0.125 inch 6063-T5 extruded aluminum hat channel with hat mounting flanges on both sides of the frame, reinforced at corners.
2. Blades:
a. Style: Airfoil-shaped, single-piece.
b. Action: Opposed.
c. Material: Heavy duty 6063-T5 extruded aluminum.
d. Width: Maximum 6 inches.
3. Bearings: Molded synthetic sleeve, turning in hole in frame.
4. Seals:
a. Blade: Extruded Ruskiprene type for ultra-low leakage from -22 to 122 degrees F. Mechanically attached to blade edge.
b. Jamb: Flexible metal compression type.
5. Linkage: Concealed in frame.
6. Axles: Minimum ½ inch diameter plated steel, hex-shaped, mechanically attached to blade.

2.11 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."Insert your information from the other spec
1. Acceptable manufacturers:
a. Belden
b. West Penn
c. Alpha
2. All unitary-to-unitary zone communication cabling shall be a minimum of 18 AWG. All other sizing of cabling shall be according to manufacturer's recommendation.
3. Wall space temperature sensor cabling (from the sensor to the unitary controller) shall have a minimum of four (4) conductors.
4. All cabling shall be stranded, Solid conductors are not allowed.
5. All cabling shall be 100% shielded with appropriate drain wire and insulation.
a. Terminate shields per manufacturer's recommendation.
6. Refer to Division 27 Section "Voice/Data Systems" for additional requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations: (as noted on plans)
   1. Gyms.
   2. Refer to drawings for additional locations.

E. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

I. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

J. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

K. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install electrical wiring and cabling according to Division 26 Section "Conductors Identifications, Splicing Devices and Connectors".
   1. Provide all power wiring for temperature controls system including but not limited to the following.
      a. Power for control panels.
         1) Power for controls for controls must be from circuits in electrical panels, (taking power from receptacles, lighting or equipment circuits is not acceptable).
         2) Label control circuits within electrical panels.
      b. Power for unitary controllers,(including all terminal devices).
         1) Power taken from the equipment it's served is acceptable provided that power is not interrupted to the electronics if the terminal unit is off for any reason.
      c. Interlock wiring including on/off control of chillers, boilers, pumps, fan-coil units, zone controls, cooling towers, etc.

d. Provide 110 VAC duplex receptacle for all temperature control panels.

D. Install signal and communication cable according to Division 27 Section "Voice/Data Systems."
1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install cable from wall mounted device, (i.e. thermostat, temperature sensor, etc.) to above ceiling in raceway.
   a. If installing new devices on existing masonry walls, conceal cabling in raceways.
      1) In finished areas use surface mounted race similar to wiremold (i.e. office, classroom).
      2) In unfinished areas use conduit, (i.e. mechanical rooms).
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

E. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

F. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test each point through its full operating range to verify that safety and operating control set points are as required.
4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
5. Test each system for compliance with sequence of operation.
6. Test software and hardware interlocks.

C. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.

8. Check DDC system as follows:
    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:
1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 09 30 - KITCHEN-HOOD VENTILATION CONTROL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes Kitchen Hood Ventilation Control Systems.

1.2 SUBMITTALS

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

B. Comply with the requirements of Division 01 Section Submittal Procedures.

C. Submit the following for approval:
   1. Product Data Sheets including the following data if applicable:
      a. Electrical Ratings
      b. Dimensions
      c. Weights
      d. Loads
      e. Required Clearances
      f. Field Connections
   2. Shop Drawings:
      a. Indicate hoods, exhaust, and supply equipment being controlled by the system.
      b. Indicate locations of sensors, system controller, VFDs and other components.
      c. Provide wiring diagrams for power, signal, and control wiring.
      d. Provide a description of Sequence of Operation
   3. Installation Instructions
      a. Indicate Installation Procedures and Scopes of Work
   4. Reference Information:
      a. Intelli-Hood Operation and Maintenance Manual.
      b. Sample Startup Report
      c. VFD Manuals

1.3 QUALITY ASSURANCE

A. All electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Control System shall be tested and certified to conform to the following standards.
   1. UL2017 – Standard for General-Purpose Signaling Devices and Systems.
   2. UL710– Standard for Exhaust Hoods for Commercial Cooking Equipment.

C. COORDINATION
   1. Coordinate installation of hood sensors in kitchen hoods listed in Division 11 Food Service Equipment.
   2. Coordinate installation of the System Controller(s), Touchpad(s), and Aux Touchpad(s)
   3. Coordinate installation of Variable Frequency Drives
   4. Coordinate installation of hood sensor wiring
   5. Coordinate power wiring of System Controller, Auxiliary Power Supplies, and Auxiliary Light Controllers.
   6. Coordinate VFD and motor power wiring.

7. Coordinate installation of VFD control wiring.
8. Coordinate installation and connections of control wiring for make-up air unit(s), air handling unit(s), pollution control exhaust fan, and any other HVAC equipment related to the kitchen ventilation system.
9. Coordinate supply fan speed and/or damper control of make-up air units or other air handlers to maintain building balance as exhaust fans modulate in speed.
10. Coordinate installation and control wiring of special hood systems such as water wash systems, ultraviolet light cleaning systems, back draft damper systems, etc.
11. Coordinate fire mode interlock and Sequence of Operation.
12. Coordinate interface of Intelli-Hood Control system to building automation network via BACnet protocol over TCP/IP
13. Coordinate connection of Intelli-Hood Control System to an internet gateway such that Intelli-Hood System Controller can connect to the Melink Intelli-Hood Server.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers of the kitchen ventilation control system are:
   1. Melink Corporation: www.melinkcorp.com, 5140 River Valley Rd. Milford OH, 45150, phone: (513) 965-7300:

2.2 SYSTEM DESCRIPTION

A. The kitchen hood Demand Control Kitchen Ventilation (DCKV) control system shall the Melink Intelli-Hood® system to include controls that sense temperature and smoke under the hood and vary the fan speed to maintain safe and effective kitchen exhaust per ASHRAE / ANSI / IES Standard 90.1 2010. Melink Intelli-Hood® Demand Control Kitchen Ventilation (DCKV) control system shall monitor cooking activity under the kitchen hood via auto-calibrated infrared Optic Sensors consisting of an Emitter and Receiver mounted on either side of the hood canopy as well as duct or canopy mounted three-wire Temperature Sensor. System shall be capable of operating exhaust fan motors at minimum speeds of 30%-50%. Optic Sensors, with dedicated Air Purge Units, shall immediately increase fan speeds to 100% upon detection of smoke or effluent in the hood canopy, upon evacuation of smoke or effluent the fans will modulate according to exhaust temperature for optimal energy savings. Temperature probes have patented Auto-Calibration feature to automatically adjust ranges via self-learning algorithms to ensure efficient operation of the kitchen ventilation system. System will actively modulate makeup airflow according to exhaust load to maintain correct space airflow balance. Demand Control Kitchen Ventilation (DCKV) system that only includes a temperature sensor to detecting cooking activity shall not be permitted. Additionally, a DCKV system that includes infrared sensors without a dedicated air purge unit and auto-recalibration of sensors shall not be permitted. Modulating dampers, automatic balancing dampers, or other devices that may impede exhaust airflow and grease extraction may not be permitted.

B. Factory assembled, modular, control system, consisting of the following components:
   1. System Controller
      a. Communicates to Hood Controller, Touchpad(s), Temperature and Optic Sensors via proprietary RS-485 Protocol.
      b. Controller capable of communicating with up to (39) Hood Controllers, (10) Touchpads, (10) Auxiliary Touchpads, (10) Auxiliary Power Supplies, and (10) Auxiliary Light Controllers.
      c. Communicates with up to (64) Variable Frequency Drives via Modbus Protocol.
      d. Programmable I/O containing (3) Digital Inputs, (4) Digital Outputs, (1) Analog Input and (1) Analog Output.
      e. Adjustable Temperature range vs. Fan Speed Curve.

f. Automatic On/Off based on hood temperature or programmable clock for individual fan schedules.
g. Removable USB memory storage for setup files and operational performance history data.
h. Calculates appropriate speeds for exhaust and supply fans based on cooking temperature demand and optical infrared monitoring.
i. Internet-based Service Application for monitoring, programming and troubleshooting.
j. BACnet over TCP/IP Interface for communication to Building Automation System.

2. Hood Controller
   a. Monitors Temperature and Optic Sensors on each kitchen hood and sends the sensor data to the System Controller via RS-485 Protocol communications.
   b. Steel beam clamps for installation on hoods or other mechanical structures above kitchen hood.
   c. Hood Controller Temperature Rating: 0° to 50°C, 32° to 120°F
3. Temperature Sensor
   a. Platinum three-wire resistive temperature device (RTD) encased in stainless steel tube.
   b. Temperature probes with patented Auto-Calibration technology to self-program based on temperature range data.
   c. Threaded housing shall be assembled in UL-Listed grease-tight fittings for installation in exhaust duct or kitchen hood canopy.
   d. Temperature sensors shall be wired to Hood Controller via 8-pin, RJ-45 connectors to the RS-485 Protocol Hood Network Cables.
   e. Temperature Rating: 0° to 535°C, 32° to 1000°F
4. Optic Sensors
   a. Optic Sensors shall consist of conformal coated Emitter and Receiver boards housed in stainless steel enclosures on opposite ends of the kitchen hood interior.
   b. Infrared sensors capable of detecting effluent in the air at any point along the length of the beam with a response time of 0.2 seconds.
   c. Sensors shall be capable of spanning 3 to 40 feet of kitchen hood interior with automatic gain adjustment.
   d. Optic sensors shall auto-calibrate every day at start up and/or every 24 hours.
   e. Sensors shall be wired to Hood Controller with liquid-tight connectors at sensor board via the Air Purge Unit.
   f. Optic Sensor Temperature Rating: 0° to 85°C, 32° to 185°F
5. Air Purge Unit (APU)
   a. Air Purge Unit (APU) consisting of a 12VDC blower and interface PCB inside an 18 gauge galvanized steel enclosure shall be installed to reduce the accumulation of contamination on the Optic Sensor lenses and reduces heat buildup inside the Optic Sensor enclosure.
   b. APU shall physically connect to the Optic Sensor enclosure via stainless steel conduit pipe.
   c. Blower fan bearings shall be permanently lubricated.
   d. APU Temperature Rating: 0° to 50°C, 0° to 125°F
6. Touchpad
   a. Full color screen, 2.8” diagonal, QVGA resolution screen to display operating status and programmable menus.
   b. Integrated membrane FANS switch for turning fans from Active Mode (On) and Standby Mode (off).
   c. Soft keys and Directional integrated membrane switches for user to boost fans to full speed, access programming menus, access diagnostic and help screens.
   d. Fully programmable graphical interface to conform to operators’ hood and fan nomenclature.
7. Aux Power Supply
   a. Aux Power Supply shall be used for large installations when additional power is needed to power Hood Controllers, Optic Sensors and Touchpads.

b. Aux Power Supply Temperature Rating: 5° to 40°C, 41° to 104°F

2.3 VARIABLE FREQUENCY DRIVES

A. Melink Corporation shall furnish VFDs that comply with Division 23 Section 0930, Variable Frequency Drive Specification.

B. Melink Corporation furnished VFDs shall control the VFDs via Modbus Protocol, unless otherwise specified.

C. Building Automation System may acquire VFD control data (stop, start, speed, fault status) from Intelli-Hood System Controller via BACnet Protocol over TCP/IP Communication. BACnet PICS available upon request.

PART 3 EXECUTION

3.1 INSTALLATION SCOPES OF WORK

A. Refer to matrix on drawings for responsibilities and scopes of work of divisions.

3.2 STARTUP SERVICE

A. A Factory-Authorized Service Representative shall perform startup service including:
1. Inspection of installed components. Verification of correct installation and operation.
2. Programming of system parameters for proper detection of cooking conditions.
3. Programming of system parameters for proper operation of control input/output points.
4. Programming of VFD parameters for proper control communication with control system.
5. Programming of VFD motor operational set points (maximum speed and allowable motor current).
6. Verification of Intelli-Hood system functionality.
7. Results shall be captured in a written report.

3.3 ADJUSTING

A. Test and Balance Contractor shall adjust hood dampers, fan pulleys, and/or VFDs to achieve maximum design airflow at maximum speed.

3.4 DEMONSTRATION

A. A Factory-Authorized Service Representative shall train Owner's maintenance personnel to adjust, operate, and maintain Packaged Kitchen Hood Ventilation Control Systems. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION

SECTION 23 09 34 - VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.2 RELATED REQUIREMENTS

A. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

E. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; 2020.

F. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems; 2022.

G. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems; 2021.

H. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

I. NEMA MG 00001 - Motors and Generators; 2024.

J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

N. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.
4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include wiring diagrams showing factory and field connections.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Manufacturer's equipment seismic qualification certification.

F. Manufacturer's certification that products meet or exceed specified requirements.

G. Field quality control test reports.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

I. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.8 WARRANTY

A. See Section 01 78 00 - 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

2.1 MANUFACTURERS

A. ABB; ACH580: www.abbnow.com

B. Yaskawa.

C. Danfoss.

D. Substitutions: See Section 01 60 00 - Product Requirements.

E. Source Limitations: Furnish variable-frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.2 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Variable-Frequency Motor Controller:
1. Configuration: Packaged controller with across-the-line bypass.
2. Rectifier/Converter: Diode-based, 6-pulse type.
3. Control Method: Scalar/volts per hertz; open-loop, without feedback.
4. Filtering: Provide input/line reactor and output/load reactor.

D. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

E. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 00001 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 00001 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.
5. Motor suitability for bypass starting method, where applicable.

F. Single Controllers Serving Multiple Motors:
1. Control Method: Scalar/volts per hertz; do not use vector control method.
2. Provide separate overload relay for each motor; provide auxiliary contacts and control wiring as required to shut down controller upon trip of any single overload relay.
3. Consider combined length of motor leads for cable length limits.

G. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

H. Operating Requirements:
1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
3. Efficiency: Minimum of 96 percent at full speed and load.
4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
5. Overload Rating:
a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

I. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
1. Rectifier/Converter: Diode-based, 6-pulse type with 5 percent reactor unless otherwise indicated.

J. Control System:
1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
1) Scalar/Volts per Hertz Control: Provide IR compensation or _____ for improved low-speed torque.
2) Vector Control: Provide selectable autotuning function.
b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
c. Selectable braking control; DC injection or flux braking.
d. Adjustable minimum/maximum speed limits.
e. Adjustable pulse width modulation switching carrier frequency.
f. Adjustable motor slip compensation.
g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
4. Status Indications:
a. Motor run/stop status.
b. Motor forward/reverse status.
c. Hand/Auto control status.
d. Output voltage.
e. Output current.
f. Output frequency.
g. DC bus voltage.
h. Motor speed.
5. Protective Functions/Alarm Indications:

a. Overcurrent.
b. Motor overload.
c. Undervoltage.
d. Overvoltage.
e. Controller overtemperature.
f. Input/output phase loss.
g. Output short circuit protection.
h. Output ground fault protection.

6. Inputs:
   a. Digital Input(s): _____.
   b. Analog Input(s): Two.
7. Outputs:
   a. Analog Output(s): Two.
   b. Relay Output(s): Three.
8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
   a. Serial Communications: RS-485; support for BACnet MS/TP protocol.
   b. Ethernet Communications: Support for Modbus TCP and BACnet IP protocol.
   c. Remote Monitoring Capabilities:
      1) Motor run/stop status.
      2) Hand-off-auto status.
      3) Fault information.
      4) Discrete input/output status.
      5) Analog input/output values.
9. Features:
   a. Password-protected security access.
   b. Event log.

K. Power Conditioning/Filtering:
   1. Provide 5-percent DC link chokes or 5-percent input/line reactor for each controller unless otherwise indicated or required.
   2. Reactor Impedance: 5 percent, unless otherwise indicated or required.

L. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
   1. Disconnects: Circuit breaker or disconnect switch type.
      a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
      b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
      c. The drive and bypass packaged shall have a UL listed short circuit current rating of 100 kA, for 240VAC and 480 VAC systems, and this rating shall be indicated on the rating label.
      d. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   2. Provide door-mounted remote operator interface.
   3. Packaged Controllers with Bypass: Provide contactors and controls to enable removal of variable-frequency controller from circuit.
      a. Bypass Method: Manual, unless otherwise indicated.
      b. Bypass Configuration: Drive isolation fuses shall be provided. Bypass designs which have no such fuses, or that only incorporate fuses common to both the drive and the bypass are not acceptable. Third contactor “isolation contactors” and service switch are not an acceptable alternative to drive isolation fuses.

c. Bypass Motor Starting Method: Full-voltage (across-the-line) with overload relay, unless otherwise indicated. The bypass shall be able to detect a single-phase input power condition while running in bypass, disengage the motor, and provide a single-phase input power indication.
d. Overload Relays: Selectable Class 10, 20, or 30 electronic motor overload protection shall be included in both drive and bypass mode..

4. Independent Bypass Keypad Requirements:
a. The bypass shall include a two-line, 20-character LCD display. The display shall allow the user to access parameters and view:
1) Bypass input voltage, current (Amps) and power (kW)
2) Bypass faults, warnings, and fault log
3) Bypass operating time and energy consumption (resettable)
b. The bypass control panel shall include the following controls:
1) Four navigation keys (Up, Down, Enter, Escape)
2) Bypass Hand-Off-Auto, Drive mode / Bypass mode selectors, Bypass reset
c. The following indicating lights (LED type) or control panel display indications shall be provided.
1) Bypass Mode Selector Switch: DRIVE/OFF/BYPASS.
2) Motor Control Selector Switch: HAND/OFF/AUTO.
3) Indicating Lights: For drive/bypass mode status, drive/bypass run status, and drive/bypass fault status.
4) Safety interlock and run permissive status shall be displayed using predetermined application specific nomenclature, such as: Damper end switch, smoke alarm, vibration trip, and overpressure.
5) The bypass shall be designed for stand-alone operation and be completely functional in both Hand and Automatic modes, even if the drive and/or drive's control board has failed. Network communications shall remain functional. Bypass systems that do not maintain full functionality in the event of a drive failure, are not acceptable.

M. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
a. Altitude: Less than 3,300 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 service conditions at installed location.

N. Short Circuit Current Rating:
1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as indicated on drawings.
2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

O. Conductor Terminations: Suitable for use with conductors to be installed.

P. Enclosures:
1. Comply with NEMA ICS 6.
2. NEMA EN 10250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
a. Indoor Clean, Dry Locations: Type 1 or Type 12.
b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

Q. 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.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
1. Molded Case Circuit Breakers:
a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated or as required.
1) Provide thermal magnetic circuit breakers unless otherwise indicated.
b. Interrupting Capacity:
1) Provide circuit breakers with a 100 KAIC interrupting capacity as required to provide short circuit current rating indicated, but not less than specified minimum requirements.
2) Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than short circuit current rating indicated.
3) Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than short circuit current rating indicated.
c. 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.
d. Provide following features and accessories where indicated or where required to complete installation:
1) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
2) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
4) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4 SECURITY FEATURES:

A. The drive manufacture shall clearly define cybersecurity capabilities for their products.

B. The drive shall include password protection against parameter changes.
1. There shall be multiple levels of password protection including: End User, Service, Advanced, and Override.
2. The drive shall support a customer generated unique password between 0 and 99,999,999.
3. The drive shall log an event whenever the drive password has been entered.
4. The drive shall provide a security selection that prevents any “back door” entry. This selection even prevents the drive manufacturer from being able to bypass the security of that drive.
5. A security level shall be available that prevents the drive from being flashed with new firmware.

2.5 NETWORK COMMUNICATIONS:

A. The drive shall have an EIA-485 port with removable terminal blocks. The onboard protocols shall be BACnet MS/TP, Modbus, and Johnson Controls N2. Optional communication cards for BACnet/IP, LonWorks, Profibus, Profinet, EtherNet/IP, Modbus TCP, and DeviceNet shall be available. The use of third party gateways are not acceptable.

B. The drive shall have the ability to communicate via two protocols at the same time, one onboard protocol and one option card based protocol. Once installed, the drive shall automatically recognize any optional communication cards without the need for additional programming.

C. The drive shall not require a power cycle after communication parameters have been updated.

D. The embedded BACnet connection shall be a MS/TP interface. The drive shall be BTL Listed to Revision 14 or later. Use of non-BTL Listed drives are not acceptable.

E. The drive shall be classified as an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC including, but not limited to:
1. Data Sharing: Read Property Multiple-B, Write Property Multiple-B, COV-B
2. Device Management: Time Synchronization-B
3. Object Type Support: MSV, Loop

2.6 SOURCE QUALITY CONTROL

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

B. Factory test controllers in accordance with NEMA ICS 61800-2.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of controllers are consistent with indicated requirements.

C. Verify that mounting surfaces are ready to accept controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

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 23 05 29.

F. Install controllers plumb and level.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Install field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

3.3 FIELD QUALITY CONTROL

A. Provide services of manufacturer's authorized representative to perform inspection and testing. Include manufacturer's reports with submittals.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.

D. Packaged Controllers with Bypass: Test for proper operation in both drive and bypass modes.

E. Correct deficiencies and replace damaged or defective controllers or associated components.

3.4 PRODUCT SUPPORT

A. Factory trained application engineering and service personnel that are thoroughly familiar with the drive products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line connected to factory support personnel located in the US and Canada shall be available.

B. Training shall include installation, programming and operation of the drive, bypass and network communications. Owner training shall be provided locally upon request.

END OF SECTION

SECTION 23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:
1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.2 DEFINITIONS

A. CHWS: Chilled Water Supply

B. CHWR: Chilled Water Return

C. CWS: Condenser Water Supply (Supply to chiller)

D. CWR: Condenser Water Return

E. DDC: Direct digital control.

F. DPT: DewPoint Temperature

G. HWS: Hot Water Supply

H. HWR: Hot Water Return

I. VAV: Variable air volume.

J. BAS: Building Automation System.

K. VFD: Variable Frequency Drive or Controller.

L. VFC: Variable Frequency Drive or Controller.

M. VFV: Variable Refrigerant Volume.

N. TAB: Test and Balance

O. FMS: Facility Monitoring System.

1.3 TRENDING FOR BUILDING COMMISSIONING

A. All diagnostic trends listed in this document shall be provided to the commissioning agent in excel (.EXE) format during the commissioning process. Coordinate additional requirements with commissioning authority prior to programming.

1.4 DISPLAY GRAPHICS

A. Provide display graphics for review with shop drawing submittals.

1.5 MODE OF OPERATION

A. Occupied:

B. Unoccupied:

C. Morning Start-up:

1.6 CHILLED WATER SYSTEM SEQUENCES (VARIABLE PRIMARY W/AIR-COOLED CHILLER)

A. General: The chilled water system will consist of two air-cooled chillers (ACCH-1A & ACCH-1B), primary chilled water pumps (P-1A & P-1B).
   1. Occupied Mode:
      a. In School: The chilled water system shall be in operate whenever air handling equipment is operational and calling for cooling.
      b. Summer: The chilled water system shall be in operate whenever air handling equipment is operational and a minimum of 5 zones are above space set point.
      c. Event: Only the lead chiller and its associated pumps shall be allowed to operate. Both chillers shall not be allowed to operate at the same time.
   2. Unoccupied Mode: Off.
   3. Optimum Start:
      a. Morning Cool-down Call: The chilled water system shall operate during morning cool down.
      b. Morning Warm-up Call: The chilled water system shall be off.

B. Chiller Sequencing: The chilled water system shall be started and stopped through the BAS. There shall be three different operating methods.
   1. Off: All chillers and pumps shall be off.
   2. Manual: The chillers and associated primary and secondary pumps shall be started manually.
   3. Automatic:
      a. Chillers shall operate per the building's occupancy schedule.
      b. Staging of chillers are automated.
      c. Chillers shall operate on lead/lag sequence with lead chiller rotating on a weekly basis, (adj).
      d. Discharge water temperature from chiller shall be maintained at 45F (adj) through the chiller's factory controls.
      e. In the event that chilled water temperature to the building, (downstream of P-2A & P-2B), rises to 47F, the lag chiller shall operate.
      f. The lag chiller shall be deactivated when chilled water temperatures to the chillers fall to 49F (adj).

C. Pump Sequencing:
   1. Whenever a chiller is activated, its respective primary chilled water pump shall be activated. The chiller's primary pump shall be started/stopped thru the chillers control panel and shall be interlocked as indicated below..
   2. Install factory-furnished chilled-water flow switches at the chiller, a chiller shall not be allowed to start unless chilled water flow is proven at the chiller.
   3. Provided each pump with a differential pressure sensor. If flow is not proven, the pump shall be deactivated and an audio-visual alarm shall sound at the BAS. In the event chilled water flow fails after the chiller is operating, the chiller and chilled water pump shall be de-activated. Once the cause of the alarm has been investigated and repaired, the chiller/pump shall be placed into normal operating conditions by resetting the system. Provide a thirty-second-time delay to prevent false alarms.

D. Variable Speed Pump Control: Primary pumps are variable flow and will distribute chilled water to the building.
   1. A variable speed drive shall be provided for each pump.
   2. Provide differential water pressure sensor and install where indicated on drawing, if location is not indicated coordinate location with engineer prior to installation.
   3. The BAS shall continuously monitor the differential pressure sensor and shall modulate as required to maintain a pressure differential set-point.
   4. The BAS system shall poll all chilled water control valves in the system on a 5-minute basis and utilize differential pressure optimization. This will be accomplished by polling all chilled water control valves and resetting the DP set-point based on AHU valve position as indicated below. The adjustable reset range will be from 3 psi to 8 psi, field calibrate value with T&B.
      a. The BAS system shall determine the two (adj) units at any give time with the most open valve position and average the position of those units. The DP setting shall be reset as required to maintain an average open position of 95%.
         1) Fan-coil units shall be excluded from the averaging process.
   5. If multiple primary pumps are operating simultaneously, each pump variable speed controller shall be operating at the same speed.

E. Operator Station Display: Indicate the following on operator workstation display terminal:
   1. DDC system graphic.
   2. DDC system status, on-off.
   3. Mode of operation, (occuipied, event, etc).
   4. Outdoor-air temperature.
   5. Cooling (software) demand indication.
   6. Time and time schedule.
   7. Primary chilled-water pump(s) on-off status.
   8. Primary chilled-water pump(s) on-off indication.
   9. Differential pressure.
   10. Differential pressure current set point.
   11. Chilled-water flow indication.
   12. Chilled-water supply temperature, (secondary loop temp to/from building).
   13. Chilled-water return temperature, (secondary loop temp to/from building).
   14. Chilled-water temperature control-point adjustment.
   15. Chiller(s) on-off status.
   16. Chiller(s) on-off indication.
   17. Chiller(s) and Pump(s) "failure-to-start" indication.
   18. Chiller(s) chilled-water supply and return temperature.
   19. Primary loop water flow (gpm).
   20. System capacity in tons, (based on secondary loop flow and supply/return water temperatures).

F. Diagnostic Trend Logs: Provide the following diagnostic trends for the chilled water system.
   1. Chilled Water System Trend #1: Chilled Water Temperatures. Points shall be trended on a 5-minute basis.
      a. Chilled water supply temperature from each chiller
      b. Primary chilled water supply temperature (to building)
      c. Primary chilled water return temperature (from building)
   2. Chilled Water System Trend #2: Pumping trend. Points shall be trended on a 5-minute basis.
      a. Primary pump(s) speed as a percent of full speed
      b. System DP reading in Feet of H20
   3. Chilled Water System Trend #3: Chilled water control valve trend. Points shall be trended on a 5-minute basis.

a. Control valve position as a percentage of full open, (calculated position, not measured) for all chilled water control valves.

1.7 HOT WATER HEATING SYSTEM CONTROL

A. General: The hot water heating system shall consist of new heating hot water boiler(s) and associated primary heating hot water pump(s) and secondary pump(s) with variable speed drives.
1. The heating hot water system shall be started and stopped through the BAS system.
2. The boiler is being provided with a factory controller that will control discharge water temperature and operation of the primary heating hot water pump(s). Refer to specification section 235216 Condensing Boilers for additional information.
3. Install the following boiler manufacture provided sensors.
a. Boiler OA temperature sensor(s) provided by boiler manufacture.
b. Install CO gas sensor provided by boiler manufacture.

B. Hot Water System Operations: The heating hot water system shall operate under the following conditions:
1. When OA temps are 60F or below, (point must be adjustable from web page).
2. When Kitchen AHU or its terminal boxes calls for heating.
3. When a Kitchen AHU calls for dehumidification
4. When a user manually places the system into operation via the web interface

C. Heating Hot Water System Sequencing:
1. Activation: When called to operate by the BAS, the following shall occur.
a. The secondary hot water heating pumps shall start and operate for a minimum of 180-seconds.
b. The BAS system shall send boiler start signal to boiler manufacture provided control panel.
1) The boiler control system shall control the operation of the boiler(s) and associated primary hot water pump(s).
2. Deactivation: When called to deactivate by the BAS, the following shall occur.
a. The secondary hot water pump(s) shall operate for a minimum of 300 seconds.

D. Primary Pump Sequencing:
1. The boiler(s) control panel shall determine when to operate a boiler’s individual primary hot water pump. Provide current transducers to determine status of primary hot water pumps.

E. Secondary Hot Water Pump Control:
1. The secondary pumps shall operate in a lead/lag sequenece with pump rotations as required to keep equal ware on the pumps.
2. The pump controller shall survey the DP sensors and adjust speed as required to satisfy setpoint.

F. Bypass Valve Control:
1. Install flow meter in the heating hot water pipe. This flow meter shall be used to control system bypass valve and maintain the minimum flow requried for boiler operation. Confirm minimum flow requirements with boiler manufacture.
2. Install bypass where indicated on plans, modulate bypass valve as required to maintain minimum boiler flow.
a. The bypass valve must be tied directly into the central plant controller, mapping of this point through other controllers is not allowed.

G. Operator Station Display: Provide graphic web page showing hot water piping schematic. The following information shall be displayed on the web page:
1. Overall system status
2. Hot water supply temperature
3. Hot water return temperature
4. HWS flow (gpm)
5. Primary pump status
6. Secondary pump, P-X, status (on/off/alarm)
7. Secondary pump, P-X, pump speed
8. DP Measured
9. Points obtainable from boiler BACnet card.

H. Diagnostic Trend Logs: The following trends shall be set-up and accessible from the hot water system web page.
1. Trend #1: Hot Water Heating General Data
   a. System status
   b. HWS Temp
   c. HWR Temp
   d. HWS Flow (gpm)
   e. Building BTU's (calculated by using flow at flow meter and HWS/R temperature)
2. Trend #2: Pump Trend
   a. Lead pump speed
   b. Primary pump(s) stat
   c. Building DP
   d. HWS GPM
3. Trend #3: Hot Water Control Valve Trend
   a. Trend valve position for all heating hot waver valves as a percentage of full open.

1.8 VAV AIR HANDLING UNITS (_____)

A. General: Unit shall consist of supply fan with VFD and chilled water coil with modulating 2-way control valve.

B. Supply Air Fan:
1. Provide differential air pressure sensor to prove fan status.
2. The supply air fan shall be controlled through a variable frequency drive (VFD).
3. Provide and install duct mounted pressure sensor approximately 2/3 way down the supply duct main, (if not indicated on drawings, confirm location with engineer prior to installing sensor). The pressure sensors shall control the operation of the supply fan VFD and shall utilize differential pressure optimization.
4. Differential pressure optimization shall be accomplished by polling all VAV box damper positions on a 5-minute basis (adj) and resetting the DP setpoint so that at minimum of 10% of terminal boxes are 90% open.
   a. Program shall be able to exclude an individual terminal box from the polling process.
5. The adjustable reset range will be from 0.5” wg to 1.25” wg, (the range shall be adjustable from the AHU web page).
6. SAF Start-up: Before starting the supply air fan, all terminal boxes associated with the air handling unit shall modulate open to their minimum damper position. Provide a minimum 1-minute delay before starting SAF to ensure all terminal box dampers are at their minimum position.
7. If less than 25% (adj) of associated terminal box air valves are completely closed, the air handling unit shall stop. If more than 25% (adj) of FVAV air valves are open, the air handling unit shall start.

C. Supply Air Temperature Control: Supply air temperature control shall be accomplished by modulating the units chilled water control valve. The specific discharge air temperature as measured in supply air duct shall be dependent on a combination of the average temperature of the individual zones and/or return air dewpoint temperature.
   1. Average Space Temperature: Each terminal box space temperature shall be polled at 5-minute intervals to determine the average difference between space temperature and space temperature setpoint.
   2. Return Air Dewpoint (DPT): Provide dewpoint sensor located in RA duct upstream of the units OA connection (if provided with OA). The unit's initial DPT setpoint shall be 55F (adj).
   3. Discharge Temperature Setpoint:
      a. Discharge temperature setpoint, when return air DPT is at or below setpoint, shall be based on the average space temperature as indicated below.
         1) Average space temperature 1°F above setpoint: Discharge air temperature 55°F (adj).
         2) Average space temperature 1°F below setpoint: Discharge air temperature 62°F (adj).
         3) Space temperature between dead band: Vary linearly.
      b. Discharge temperature setpoint when return air DPT is above set point shall be as follows:
         1) Return Air DPT below or at setpoint: Discharge air temperature programed setpoint based on average space temperature above.
         2) Return Air DPT 1.5°F above setpoint: Discharge air temperature 55°F (adj).
         3) DPT between dead band: Vary linearly.

D. UV Lights: These units are equipped with UV lights. 120V power is being provided by Division 26 contractor, provide relays and contacts as required to control lights so that lights are on only when the supply air fan is operating.

E. Display Points:
   1. DDC system web page
   2. Fan status (on/off/failure to run)
   3. Duct static pressure
   4. Duct static pressure setpoint
   5. Average space temperature setpoint differential
   6. Supply fan speed (% of full speed not HZ)
   7. Discharge air temperature
   8. Discharge air temperature setpoint
   9. Return air DPT.
   10. Return air temperature (mount adjacent to DP sensor in ductwork away from OA connection).
   11. Mixed air temperature.
   12. Coiling-coil control valve % of full open (software point, not actual measured)
   13. CHWR water temperature

F. Diagnostic Trends: The following points shall be trended on a common web page accessible by clicking on an icon from the unit's system web page.
   1. VAV AHU Trend #1: To be trended on change of state
      a. AHU Run Command
      b. Fan status
   2. VAV AHU Trend #2: (To be trended on a 5-minute basis)
      a. Fan speed (Percentage of max not HZ)
      b. Duct static pressure
      c. Average position of connected terminal box air valves
      d. Average space temperature setpoint difference

e. Discharge air temperature
f. Discharge air temperature setpoint
g. Return air DP temperature

3. VAV AHU Trend #3: (To be trended on a 5-minute basis)
   a. Discharge air temperature
   b. Discharge air temperature setpoint
   c. Average space temperature of connected terminal boxes
   d. Return air temperature
   e. Return air DP temperature
   f. Control valve % opened
   g. Chilled water coil return water temperature
4. VAV AHU Trend #3: (To be trended on a 5-minute basis)
   a. Provide trend of damper position for all terminal boxes connected to unit on one common page.

1.9 SINGLE ZONE VARIABLE SPEED AIR HANLDING UNIT (_____)

A. General: Unit shall consist of supply fan with VFD, chilled water coil with modulating 2-way control valve and re-heat coil with modulating 2-way control valve. Space temperature setpoint shall be input through the unit's web page, a minimum of 4°F offset shall be provided between the heating and cooling setpoints.

B. Space Temperature Sensor Types: Combination temperature and humidity.

C. Supply Air Fan:
1. Provide differential air pressure sensor to prove fan status.
2. The supply air fan shall be controlled through a wall-mounted variable frequency drive (VFD).
3. A space mounted temperature sensor(s) shall control the speed of the supply air fan. The maximum airflow shall be set by the TAB with minimum airflow being 30% (adj) of the maximum airflow.
   a. When multiple space mounted temperature sensors are indicated on the plans, an average temperature shall be determined from the sensors.

D. Space Temperature Control: A wall mounted temperature sensor(s) shall maintain space temperature by modulating the units SAF and control valves as follows.
1. Supply Air Fan Control: The supply air fan shall modulate based on space temperature, a 2°F (adjustable) dead band shall be utilized to control the fans speed for both heating and cooling systems as follows
   a. Cooling Mode:
      1) Space temperature 1°F below setpoint: Supply fan shall be at minimum speed.
      2) Space temperature 1°F above setpoint: Supply fan shall be at maximum speed.
      3) Space temperature between 1°F below and 1°F above setpoint: Vary linearly.
   b. Heating Mode:
      1) Space temperature 1°F below setpoint: Supply fan shall be at maximum speed.
      2) Space temperature 1°F above setpoint: Supply fan shall be at minimum speed.
      3) Space temperature between 1°F below and 1°F above setpoint: Vary linearly.
   c. When space temperatures are between the cooling and heating dead band range, the supply fans shall be at its minimum setpoint.
2. Chilled Water and Reheat Coil Control: The control valves shall modulate based on space temperature, a 2°F (adjustable) deadband shall be utilized to control to a specific discharge air temperature.
   a. Chilled Water Coil Control Valve:
      1) Space temperature 1°F below setpoint: Discharge air temperature 62°F (adj).
      2) Space temperature 1°F above setpoint: Discharge air temperature 55°F (adj).

3) Space temperature between limits: Vary linearly.

b. Hot Water Reheat Coil Control Valve:
1) Space temperature 1°F below setpoint: Discharge air temperature 85°F (adj).
2) Space temperature 1°F above setpoint: Discharge air temperature 72°F (adj).
3) Space temperature between limits: Vary linearly.

c. When space temperatures are between the cooling and heating dead band range, both cooling and heating control valves shall be closed.

3. Dehumidification Mode:
a. Air handling units shall only be allowed to enter dehumidification mode when space temperatures are a minimum of 1F above the heating setpoint.
b. The unit shall enter dehumidification mode if space DPT increase above the setpoint of 55F (adj). There shall be three (3) different stages of dehumidification.
1) Stage 1 dehumidification (between DPT setpoint and 1F above DPT):
(a) CWC control valve shall modulate to maintain a maximum discharge air temperature of 57F.
2) Stage 2 dehumidification (DPT is 1-2F above DPT setpoint):
(a) CWC control valve shall modulate to maintain a discharge air temperature of 55F.
3) Stage 3 dehumidification (DPT is 2F above setpoint): Before entering Stage 3 dehumidification, space temperatures must be less than or equal to the space setpoint and the heating hot water system must be proven operational, (i.e. boiler and hot water pump(s) active with HWS temp above 100F). If these conditions are not met, the unit shall remain at Stage 2 dehumidification. If these conditions are met, the following shall occur. The unit shall remain in Stage 3 dehumidification until space humidity levels drop to entering Stage 1 conditions, (DPT is 1F above setpoint).
(a) Discharge air temperature shall be set to 54F (adj).
(b) The fan speed shall be set to 75% of maximum speed.
(c) The reheat coil shall modulate as required to maintain space temperature setpoint.

E. UV Lights: These units are equipped with UV lights. 120V power is being provided by Division 26 contractor, provide relay's and contacts as required to control UV lights so that the equipment is on only when the supply air fan is operating.

F. Display Points:
1. DDC system web page
2. Space temperature (if more than one sensor is present show temperature for each sensor and the average temperature)
3. Space humidity level (if more than one sensor is present show temperature for each sensor and the average temperature)
4. Space DPT temperature, (calculated valvue using the space temperature space humidity level measured at the combo tstat/humidi stat, if more than one sensor is present, this should be an average value between the sensors)
5. Fan status (on/off/failure to run)
6. Supply fan speed (% of full speed not HZ)
7. Discharge air temperature
8. Discharge air temperature setpoint
9. Return/Mixed air temperature (if unit has OA connection, this temperature shall be downstream of the connection reflecting the CWC inlet coil temp)
10. Coiling-coil control valve % of full open (software point, not actual measured)
11. Heating-coil control valve % of full open (software point, not actual measured)
12. Chilled water coil return water temperature
13. Dehumidification mode status
14. Hot water heating system status

G. Trend Points: The following points shall be trended on a common web page accessible by clicking on an icon from the unit's system web page.
   1. SZU AHU Trend #1: To be trended on change of state
      a. AHU Run Command
      b. Fan status
   2. SZU AHU Trend #2:
      a. Fan status
      b. Fan speed (% of full speed not HZ)
      c. Average space temperature
      d. Average space RH
      e. Average space DPT
      f. Return/Mixed air temperature
   3. SZU AHU Trend #3:
      a. Discharge air temperature
      b. Discharge air temperature set-point
      c. Cooling coil control valve % open
      d. Heating coil control valve % open
      e. Chilled water coil return water temperature

1.10 DEDICATED OUTSIDE AIR UNIT (DOAU) WITH ENERGY RECOVERY WHEEL (_____)

A. General: Units consist of supply fan(s) with VFD, exhaust fan(s) with VFD, enthalpy wheel with bypass damper, face & bypass damper, chilled water coil with 2-way modulating control valve, hot water coil with 2-way modulating control valve, 2-way 2-position damper at connection to OA louver and 2-way 2-position at connection to EA damper.
   1. Occupied Mode: The air handling unit shall be placed into operation by the BAS based upon user defined schedule.
   2. Unoccupied Mode: During the unoccupied mode, the supply air fan shall de-activate, exhaust fan de-activate, energy recovery wheel shall de-activate and outside air/exhaust air dampers close.

B. Supply Fan Speed Control:
   1. Before supply fan start, 2-way 2-position OA damper shall open.
   2. A differential air pressure sensor shall prove fan status.
   3. The supply air fan shall be controlled through a unit-mounted variable frequency drive (VFD).
   4. Provide and install duct mounted pressure sensors 3/4 of the distance out in the system, (field verify location with engineer). The pressure sensors shall control the operation of the supply fan VFD and shall utilize differential pressure optimization.
   5. Differential pressure optimization shall be accomplished by polling all VAV box damper positions and resetting the DP set-point so that at least one VAV damper is 95% open.
   6. The adjustable reset range will be from 0.3" wg to 1.25" wg.

C. Exhaust Fan Speed Control:
   1. Before the exhaust fan start, 2-way 2-position EA damper shall open.
   2. Modulate exhaust fans VFD at same percentages as supply fan.

D. Toilet Room Exhaust Control:
   1. General: Two main exhaust trunks are routed directly back to the OA unit, a constant flow Toilet Room Exhaust trunk and a Variable Flow Exhaust trunk.
      a. Toilet Room Exhaust: Provide DP pressure sensor located at manual balancing damper as indicated on drawings. This sensor shall be used to modulate the control damper in the "Variable Flow Exhaust" trunk.

b. Variable Flow Exhaust Trunk: Provide modulating control damper at location indicated on drawings. This damper shall modulate as required to maintain a constant static pressure drop over manual balancing damper installed in “Toilet Room Exhaust Trunk”. The pressure loss value shall be field calibrated with T&B contractor.

E. Discharge Air Temperature Controls:
1. A duct mounted discharge air temperature sensor shall control the units face & bypass (F&B) dampers, 2-way chilled water control valve and 2-way hot water valve.
   a. General requirements:
      1) Provide temperature sensor at chilled water coil serpentine across the entire face of the water coil every six inches on center. This temp sensor shall control the operation of the coils control valve.
      2) Provide duct mounted temperature sensor to control the operation of the units F&B damper.
   b. When outdoor air temperature is above 75F (adj):
      1) The energy recovery wheel shall operate, (wheel bypass damper shall be closed).
      2) Chilled water valve control: Control of the chilled water control valve shall be dependent on the position of the F&B damper. Provide a 5% deadband as follows
         (a) F&B damper open more than 10% to the chilled water coil the control valve: Modulate as required to maintain a 55F leaving coil temperature.
         (b) F&B damper less than 10% to the chilled water coil: Chilled water valve shall close and remain close until F&B damper is more than 15% open to the coil.
      3) Face and bypass damper shall modulate as required to maintain 65F (adj) discharge air temperature.
      4) Dehumidification Mode: If dewpoint (DPT) in the variable flow exhaust duct from the building rises to 55F (adj), the discharge air temperature shall be reset as follows:
         (a) DPT temperature 1.5F above DP setpoint = 57F (adj) Discharge air temp
         (b) DPT temperature at DPT setpoint = 65F (adj) Discharge air temp
         (c) Between 1.5F above & setpoint (55DPT) = Vary linearly between 57F & 65F.
   c. When outdoor air temperature is between 75 degrees F (adj.) and 60 degrees F (adj.).
      1) The energy recovery wheel shall not operate, and its associated bypass damper shall be open.
      2) Chilled water valve control: Control of the chilled water control valve shall be dependent on the position of the F&B damper. Provide a 5% deadband as follows
         (a) F&B damper open more than 10% to the chilled water coil the control valve: Modulate as required to maintain a 55F leaving coil temperature.
         (b) F&B damper less than 10% to the chilled water coil: Chilled water valve shall close and remain close until F&B damper is more than 15% open to the coil.
      3) The face and bypass damper shall modulate as required to maintain discharge air temperature.
      4) Dehumidification Mode: Dehumidification mode shall match sequence for when OA temps are above 75F
   d. When the outdoor air temperature is below 60°F.
      1) The energy recovery wheel shall operate, and the wheels bypass damper shall be closed.

2) The face and bypass damper shall be in full face mode, (all airflow through the heating coil).
3) The 2-way hot water control valve shall modulate as required to maintain 65F (adj) discharge air temperature.

F. System Start-up: When a unit has been called to start-up by the BAS, the following shall occur in sequential order:
1. The units control valve shall open to a minimum position of 50% (adj) or as required to achieve discharge air temperature (whichever is greater) for a minimum period of 15 minutes (adj).
2. The supply fan shall activate and operate under its normal sequence.
3. After the start-up period, the valve shall return to its normal operating mode.
   a. The closing speed of the chilled water control valve shall not be allowed to exceed more than 10% per minute (adj) when switching back from Morning Cool-down Mode to normal operations mode.

G. System Shut-down: When a unit has been called to shut-down by the BAS, the following shall occur in sequential order:
1. The units 2-way control valve shall lock in its current position while SA & EA fans are deactivated.
2. The SA and EA fans speed shall be reduced to its minimum setting over a period of 5 minutes (adj).
3. Once SA & EA fans have reached their minimum set-point, the SA and EA fans shall be deactivated.
4. After SA & EA fans have been deactivated, the units chilled water control valve shall close.
   a. The closing speed of the chilled water control valve shall not be allowed to exceed more than 10% per minute (adj) during System Shut-down mode.

H. Freeze Protection:
1. Freeze protection wire shall be serpentine across the entire face of the water coil every six inches on center.
   a. A low limit temperature sensor shall be located on the downstream side of the hot water coil.
   b. If a temperature of 40 degrees F (adj.), or less is detected, then the supply air and exhaust air fans shall stop, outside air and exhaust air dampers shall fully close, the hot water control valve shall go full open, and an audio/visual alarm shall activate through the BAS.
   c. Upon correction of the problem, the system shall be reset and shall return to normal operation.

I. Temperature Indication: Provide air temperature indication in the supply and return ducts and entering/leaving air temperature to each water coil.

J. UV Disinfection: The UV Disinfection system shall be on when the unit is active, provide relays and contactors as required to control manufactured supplied UV lights.

K. Operator Station Display: Indicate the following on operator workstation display terminal:
1. DDC system graphic.
2. DDC system on-off indication.
3. DDC system occupied/unoccupied mode.
4. Outdoor-air-temperature indication.
5. Outdoor humidity indication (measured at inlet OA duct)
6. Outdoor CO2 ppm level, (obtain from FMS).
7. Enthalpy wheel status, (on/off/failure to start).

8. Enthalpy wheel inlet exhaust temperature
9. Enthalpy wheel outlet exhaust temperature
10. Enthalpy wheel inlet supply temperature
11. Enthalpy wheel outlet supply temperature
12. Enthalpy wheel bypass damper position
13. Supply-fan on-off indication, (on/off/failure to start).
14. Supply-fan-discharge static-pressure indication.
15. Supply-fan-discharge static-pressure set point.
16. Supply-fan airflow rate.
17. Supply-fan speed.
18. Exhaust-fan on-off indication, (on/off/failure to start).
19. Exhaust-fan-discharge static-pressure indication.
20. Exhaust-fan-discharge static-pressure set point.
21. Exhaust-fan airflow rate.
22. Exhaust-fan speed.
23. Face & bypass damper status.
24. Face & bypass damper position.
25. Relative humidity indication, (EA inlet duct and OA outlet duct).
26. Supply filter air-pressure-drop indication.
27. Supply filter low-air-pressure set point.
28. Supply filter high-air-pressure set point.
29. Exhaust filter air-pressure-drop indication.
30. Exhaust filter low-air-pressure set point.
31. Exhaust filter high-air-pressure set point.
32. OA-discharge air-temperature indication, (from sensor mounted in discharge duct).
33. OA-discharge air-temperature set point, (from sensor mounted in discharge duct).
34. Cooling-coil air-temperature indication.
35. Cooling-coil air-temperature set point.
36. Cooling-coil control-valve position (calculated not measured).
37. Chilled water return temperature.
38. Heating-coil air-temperature indication.
39. Heating-coil air-temperature set point.
40. Heating-coil control-valve position (calculated not measured).
41. Freeze stat status.
42. UV Disinfection Status.

L. Trend Points: The following points shall be trended on a common web page accessible by clicking on an icon from the unit's system web page.
1. DOAU Trend #1: (To be trended on a 5-minute basis)
    a. SA fan speed
    b. Energy wheel status
    c. DPT
    d. Discharge air temperature setpoint
    e. Discharge air temperature
    f. Face & Bypass Damper Position
    g. CHWR temperature
2. DOAU Trend #2: (To be trended on a 5-minute basis)
    a. Supply duct static pressure
    b. Toilet exhaust static pressure
    c. General exhaust duct damper position
3. DOAU Trend #3
    a. Chilled Control valve % opened
    b. Hot Control valve % opened
    c. Face & Bypass Damper Position
    d. Chilled water return water temperature

4. VAV AHU Trend #3: (To be trended on a 5-minute basis)
    a. Provide trend of damper position for all terminal boxes connected to unit on one common page.

1.11 FAN-COIL UNIT CONTROL

A. Fan-Coil Unit with Chilled and Hot Water Coil
1. General: Fan-coils consist of ECM supply motor, 2-way chilled water coil control valve, 2-way hot water coil control valve and condensate overflow switch.
    a. Provide and install condensate overflow alarm that will stop unit on alarm
2. Space Temperature Sensor Types: Flat Plate type.
3. Occupancy: Terminal boxes shall be placed into operation based on a time of day schedule through the front-end control system.
4. Space Temperature Control, Cooling: When cooling is required, modulate supply fan and chilled water control valve as required to maintain space temperature setpoint. (Heating valve shall be closed at this time).
5. Space Temperature Control, Heating: When heating is required, modulate supply fan and hot water control valve as required to maintain space temperature setpoint. (Heating valve shall be closed at this time).
6. Display:
    a. DDC system graphic
    b. Room/area served
    c. Space temperature
    d. Space temperature setpoint
    e. Discharge air temperature
    f. Chilled water control valve position as a percent of full
    g. Hot water control valve position as a percent of full
    h. Condensate overflow alarm
7. Trends: The following points shall be trended on a common web page accessible from the unit's web page.
    a. Fan status
    b. Space temperature
    c. Discharge air temperature
    d. Chilled water control valve position
    e. Hot water control valve position

1.12 TERMINAL UNIT OPERATING SEQUENCES

A. General Requirements: When a Terminal box for space cooling and terminal box for OA control are in the same room and serve the same area, they shall be displayed on the same web page.

B. Space Temperature Sensor Types: Flat Plate type shall be installed throughout with limited exceptions in the Administration Suite.
1. Refer to detail on drawings for temperature sensors located in:
    a. Principal's Office, Temperature Sensor and +/- 2 Deg. Temp Setpoint Adjustment
    b. Conference Room, Temperature Sensor and +/- 2 Deg. Temp Setpoint Adjustment
    c. Teachers Training Room, Temperature Sensor and +/- 2 Deg. Temp Setpoint Adjustment

C. Series Fan Powered VAV Box, (FVAV) with Electric Heating
1. Occupancy: Terminal boxes shall be active when associated AHU is operational.

a. Unit Shutdown: When the terminal units associated AHU has been shut down, the air valve in the terminal box shall 1st modulate to 100% open, then modulate closed then modulate back to 50% open. The damper shall remain 50% open until after the SAF has started, after unit operation has been proved, the unit shall operate per this sequence.

2. Space Temperature Control:
   a. The supply fan shall be balanced to connected grille total listed on the drawings.
   b. When cooling is required, the air valve shall modulate between its minimum and maximum setting as required to maintain space temperature, (the maximum setting shall equal the total airflow connected to the terminal box).
   c. If space temperatures drop 2F (adj) below cooling set point, the air valve shall go 100% closed.
   d. If heating is required, the supply air damper shall fully close, and the electric heating coil shall modulate as required to satisfy set-point temperature.
3. Display:
   a. DDC system graphic.
   b. Room/area served.
   c. Maximum set point, (GRD Total).
   d. Room temperature indication.
   e. Room temperature set point.
   f. Air-damper position as percent open.
   g. Airflow.
   h. Electric heating coil status/percent of load.
4. Diagnostic Trends: The following points shall be trended on a common web page accessible from the terminal box's web page.
   a. Space temperature setpoint
   b. Space temperature
   c. Airflow
   d. Air-damper position as percent open.
   e. Discharge air temperature
   f. Percent of full load heating.

D. Single Inlet Terminal Box, (VAV) for cooling only
1. General: This box provides cooling to the MDF room and other similar spaces.
2. Occupancy:
   a. Occupied Mode: The terminal unit shall be placed into operation by the BAS based upon user defined schedule.
   b. Unoccupied Mode: During the unoccupied mode, the terminal box shall stroke 100% closed then modulate back to a 50% open position.
3. Air Valve Control: The air valve shall modulate from 0 – CFM listed on drawings as required to maintain space temperature set-point.
4. Display:
   a. DDC system graphic.
   b. Space Temp Set-point
   c. Space Temperature
   d. Airflow.
   e. Air-damper position as percent open.
5. Diagnostic Trends: The following points shall be trended on a common web page accessible from the terminal box's web page.
   a. Airflow
   b. Air-damper position as percent open.

E. Single Inlet Terminal Box, (VAV) for Space CO2 Control
1. General: This box is connected to OA Unit and is used to control space CO2 levels. It is a variable volume box.

2. Occupancy:
   a. Occupied Mode: The terminal unit shall be placed into operation by the BAS based upon user defined schedule.
      1) Unit Shutdown: When the terminal units associated AHU has been shut down, the air valve in the terminal box shall 1st modulate to 100% open, then modulate closed then modulate back to its minimum position. The damper shall remain at its minimum position until after the SAF has started, after unit operation has been proved, the unit shall operate per this sequence.
   b. Unoccupied Mode: During the unoccupied mode, the terminal box shall stroke 100% closed then modulate back to a 50% open position.
3. Space CO2 Control:
   a. Obtain space CO2 differential from the Facility Monitoring System.
   b. The variable air inlet damper shall modulate between the minimum and maximum air flow rates as required to maintain a space differential of 500 ppm (adj) between OA and space CO2 levels.
4. Display:
   a. DDC system graphic.
   b. Room/area served.
   c. Minimum set point.
   d. Maximum set point.
   e. CO2 differential, (from FMS)
   f. Room occupied/unoccupied.
   g. Air-damper position as percent open.
   h. Actual airflow.
5. Diagnostic Trends: The following points shall be trended on a common web page accessible from the terminal box's web page.
   a. Airflow
   b. Air-damper position as percent open.
   c. Space CO2 DP

F. Single Inlet Terminal Box, (CAV)
1. General: This box is connected to OA unit and provides code required ventilation to the space. It is a constant volume box and is NOT controlled by space CO2 levels.
2. Occupancy:
   a. Occupied Mode: The terminal unit shall be placed into operation by the BAS based upon user defined schedule.
   b. Unoccupied Mode: During the unoccupied mode, the terminal box shall stroke 100% closed then modulate back to a 50% open position.
3. Air Valve Control: The air valve shall modulate as required to maintain a constant air volume as indicated in the drawings.
4. Display:
   a. DDC system graphic.
   b. Room/Area/AHU served.
   c. CFM Set-point, (terminal box is constant volume).
   d. Room occupied/unoccupied.
   e. Air-damper position as percent open.
   f. Actual airflow.
5. Diagnostic Trends: The following points shall be trended on a common web page accessible from the terminal box's web page.
   a. Airflow
   b. Airflow setpoint
   c. Air-damper position as percent open.

1.13 GENERAL EXHAUST FAN CONTROL

A. General: Where exhaust fans are provided for general exhaust purposes, (refer to plans for actual location), interlock exhaust fan with air handling unit servicing general area. Provide and install CT on motor for status check.

1.14 DISHWASHER HOOD EXHAUST SYSTEM

A. General: Interlock dishwasher with exhaust fan. Provide and install CT on motor for status check.

B. Display:
1. DDC system graphic.
2. Exhaust fan status.
3. Dishwasher fan status.

1.15 KITCHEN REFRIGERATOR AND FREEZER

A. General: Provide a wall-mounted temperature sensor in the walk-in refrigerator and freezer units to monitor temperature.
1. If temperatures exceed a pre-designated set-point (adj) an alarm shall be generated at the BAS

B. Display and Trend Points: Provide display for freezer and cooler and trend points on a 5-minute basis.

1.16 HIGH VOLUME LOW SPEED CEILING FAN

A. General: These fans are being provided with local speed control by the manufacturer. Provide start/stop signal via occupancy schedule. Coordinate requirements with fan manufacture.

B. Display:
1. DDC system graphic.
2. Fan status.

1.17 VENTILATION FANS

A. General: These fans are being provided cooling of IT closets, refer to drawings and schedules for quantity and locations. Provide space mounted temperature sensor to control fan. Fan shall operate to maintain 80F setpoint in area served.

B. Display:
1. DDC system graphic.
2. Fan status via CT.
3. Space temperature

1.18 DUCTLESS SPLIT SYSTEMS, IT CLOSET COOLING

A. General: Ductless split systems shall operate under their own control, install, and wire manufacturer provided thermostat. Provide the following additional controls components:
1. Condensate overflow alarm in drain pan.
2. Wall mounted temperature sensor to allow monitoring of space temperature.

B. Display:
1. Space temperature.

2. Space temperature alarm
3. Condensate overflow alarm

1.19 EXTERIOR LIGHTING CONTROL:

A. General: Three (3) mechanically held contactor type relay panels are being provided for building site-lighting control. The panels are in Electrical Rooms A121, B125 & C109. Refer to lighting control detail for additional requirements.

B. Lighting Control: Provide time of day control via exterior lighting schedule, both lighting controllers shall use a common schedule.

C. Display:
1. Status
2. Lighting schedule

1.20 SHELTER IN PLACE

A. General: A wall mounted push button in the principal's office shall activate a "shelter-place" mode. Under this condition, all OA equipment and Exhaust equipment, (with the exception of the kitchen hood system) shall be shut down.

1.21 DOMESTIC WATER HEATERS

A. General: Provide control of domestic water recirculation pumps. Pumps shall be controlled via a time-of-day schedule.

B. Display:
1. Pump status via current sensor (for each pump)
2. Discharge water temperature from domestic water heaters serving kitchen.
3. Discharge water temperature from domestic water heaters general building.

1.22 BUILDING HUMIDITY SENSORS

A. General: Provide wall mounted humidity sensors were indicated on the drawings.

B. Display: Floor plan with location of humidity sensors including.
1. Wall mounted humidity sensors
2. Humidity sensors mounted in the RA or EA duct of AHU and/or OA units

1.23 ENERGY METER: THIS REQUIRES EDITING!!!!

A. General: Provide connection to main switch gear electrical meter (provided by electrical contractor) and record information via the BAS. The BAS system shall provide in report format the following information.
1. Daily KWH and kw
2. Weekly KWH and kw
3. Monthly KWH and kw
4. Year to Date KWH and kw
5. Previous year KWH and kw

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water and glycol piping, above grade.

C. Chilled water piping, above grade.

D. Condenser water piping, above grade.

E. Equipment drains and overflows.

F. Pipe hangers and supports.

G. Unions, flanges, mechanical couplings, and dielectric connections.

H. Valves:
1. Ball valves.
2. Butterfly valves.
3. Check valves.

1.2 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.

B. Section 23 07 19 - HVAC Piping Insulation.

C. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.3 REFERENCE STANDARDS

A. 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; 2023.

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 B31.9 - Building Services Piping; 2020.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

H. ASTM B32 - Standard Specification for Solder Metal; 2020.

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

K. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

L. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2020.

M. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.

N. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2020.

O. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2021a.

P. 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.

Q. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

R. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

S. ASTM F2389 - Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems; 2023.

T. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

V. AWWA C606 - Grooved and Shouldered Joints; 2022.

W. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.4 SUBMITTALS

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

B. Product Data:
1. Include data on pipe materials, pipe fittings, valves, and accessories.

1.5 QUALITY ASSURANCE

A. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary protective coating on cast iron and steel valves.

PART 2 PRODUCTS

2.1 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 any location.
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. Grooved mechanical connections and joints comply with AWWA C606.
c. 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. On discharge of condenser water pumps, use spring-loaded check valves.
3. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
4. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
5. For throttling and isolation service in chilled and condenser water systems, use only butterfly valves.
6. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.2 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), 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. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.3 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard 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. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.4 CONDENSATE DRAIN PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, galvanized.
1. Threaded Joints: ASME B16.3, malleable iron fittings with finish matching piping.
2. Cold Press Mechanical Joints: Mechanical joint fitting system shall conforming to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI LC-4/CSA 6.32.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard 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.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
1. Fittings: ASTM D2466 or ASTM D2467, PVC.
2. Joints: Solvent welded in accordance with ASTM D2855.

D. PVC Pipe: ASTM D1785, Schedule 80, or ASTM D2241, SDR 21 or 26.
1. Fittings: ASTM D2466 or ASTM D2467, PVC.
2. Joints: Solvent welded in accordance with ASTM D2855.

2.5 CONDENSER WATER PIPING, ABOVE GRADE INTERIOR

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings with finish matching piping; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings with finish matching piping.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.6 CONDENSER WATER PIPING, ABOVE GRADE EXTERIOR

A. PVC Pipe: ASTM D1785, Schedule 80, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466 or ASTM D2467, PVC.
   2. Joints: Solvent welded in accordance with ASTM D2855.

B. Pressure-Rated Polypropylene Pipe: ASTM D2774 or ASTM F2389, PP-RCT resin pipe with fiber layer, SDR 17.6 or SDR 11.

2.7 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
   1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

2.8 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.
   3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   9. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 6 Inches and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   14. Floor Support for Hot Pipe Sizes 6 Inches and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
   15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   16. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   17. 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.

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.

2.9 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:
   1. Ferrous Piping: 150 psi brass or malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick, preformed neoprene.

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.

D. Dielectric Connections:
   1. Waterways:
      a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      b. Dry insulation barrier able to withstand 600-volt breakdown test.
      c. Construct of galvanized steel with threaded end connections to match connecting piping.
      d. Suitable for the required operating pressures and temperatures.
   2. Flanges:
      a. Dielectric flanges with same pressure ratings as standard flanges.
      b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      c. Dry insulation barrier able to withstand 600-volt breakdown test.
      d. Construct of galvanized steel with threaded end connections to match connecting piping.
      e. Suitable for the required operating pressures and temperatures.
   3. Unions:
      a. 1/2 to 1 Inches: Brass solder to galvanized FPT.
      b. 1/2 to 2 Inches: Brass solder to galvanized FPT.
      c. 1/2 to 1 Inches: Brass to galvanized FPT or FIP (Female Iron Pipe).
      d. 3/4 to 1/2 Inch Reducer: Brass solder to galvanized FPT.
      e. Service: 250 psi, minus 20 to 180 deg F.

2.10 ACCEPTABLE VALVE MANUFACTURES

A. Manufacturers:
   1. Apollo Valves
   2. Nibco
   3. Victaulic Company
   4. Watts Corporation

2.11 BALL VALVES

A. Up To and Including 2 Inches:
   1. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

2.12 BUTTERFLY VALVES

A. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, grooved, or _____ ends, extended neck.

B. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, Buna-N encapsulation, or _____.

C. Operator: 10 position lever handle.

2.13 SWING CHECK VALVES

A. Up To and Including 2 Inches:
1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

B. Over 2 Inches:
1. Iron body, bronze or _____ trim, stainless steel, bronze, bronze faced rotating, or _____ swing disc, renewable disc and seat, flanged, grooved, or _____ ends.

2.14 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer, or threaded lug ends.

PART 3 EXECUTION

3.1 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 23 25 00 for additional requirements.

3.2 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.

E. Sleeve pipe passing through partitions, walls, and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified _____.

G. Slope piping and arrange to drain at low points.

H. Grooved Joints:
1. Install in accordance with the manufacturer's latest published installation instructions.

I. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 07 19.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00 .

L. Install valves with stems upright or horizontal, not inverted.

3.3 INSTALLATION OF BELOW GRADE PIPING

A. Excavation for Utility Trenches
1. Excavate trenches to indicated gradients, lines, depths, and elevations.
   a. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line. Provide bentonite “trench plug” that extends at least 5 feet out from the face of the building’s exterior.
2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   a. Clearance: 12 inches each side of pipe.
3. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
   a. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

B. Utility Trench Backfill
1. Place backfill on subgrades free of mud, frost, snow, or ice but not before completing the following.
   a. Testing and inspecting underground utilities.
   b. Removing trash and debris.
2. Trench backfill from 6” below pipe to 12” above shall be concrete stabilized bank sand.
   a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
3. Place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
4. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil.
5. Backfill voids with satisfactory soil while removing shoring and bracing.

3.4 SCHEDULES

A. Pipe Application:
1. Chilled Water Piping, Interior or Exterior Above Ground:
   a. Piping 2-inch and less: Copper pipe with brazed or press-fit joints or Steel pipe with screwed fittings.
   b. Piping 2.5-inch and greater: Steel pipe with welded, flanged, or grooved fittings.
2. Hot Water Piping, Interior or Exterior Above Ground:

a. Piping 2-inch and less: Copper pipe with brazed or press-fit joints or Steel pipe with screwed fittings.
b. Piping 2.5-inch and greater: Steel pipe with welded, flanged, or grooved fittings.

3. Condenser Water Piping, Interior Above Grade:
   a. All pipe sizes: Steel pipe with welded fittings.
4. Condenser Water Piping, Exterior Above Ground:
   a. Piping 2-inch and less: Sch 80 PVC with solvent fitting or HDPE with heat fused joints.
   b. Piping 2.5-inch and greater: Sch 80 PVC or HDPE with heat fused joints.
5. Chilled Water, Exterior Below Ground:
   a. All Pipe Sizes: HDPE piping with heat fused joints.
6. Condensate and Drain Piping:
   a. Piping 2-inch and less: Galvanized steel pipe with screwed fittings.
7. Makeup-water Piping, Above Ground:
   a. Piping 2-inch and less: Copper pipe with brazed or press-fit joints.

B. 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.

C. Hanger Spacing for Steel Piping.
1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 Inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. 8 Inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.
10. 10 Inches: Maximum span, 20 feet; minimum rod size, 3/4 inch.
11. 12 Inches: Maximum span, 23 feet; minimum rod size, 7/8 inch.

D. Hanger Spacing for Plastic Piping.
1. 1/2 Inch: Maximum span, 42 inches; minimum rod size, 1/4 inch.
2. 3/4 Inch: Maximum span, 45 inches; minimum rod size, 1/4 inch.
3. 1 Inch: Maximum span, 51 inches; minimum rod size, 1/4 inch.
4. 1-1/4 Inches: Maximum span, 57 inches; minimum rod size, 3/8 inch.
5. 1-1/2 Inches: Maximum span, 63 inches; minimum rod size, 3/8 inch.
6. 2 Inches: Maximum span, 69 inches; minimum rod size, 3/8 inch.
7. 3 Inches: Maximum span, 7 feet; minimum rod size, 3/8 inch.
8. 4 Inches: Maximum span, 8 feet; minimum rod size, 1/2 inch.
9. 6 Inches: Maximum span, 10 feet; minimum rod size, 1/2 inch.
10. 8 Inches: Maximum span, 11 feet; minimum rod size, 5/8 inch.
11. 10 Inches: Maximum span, 13 feet; minimum rod size, 3/4 inch.
12. 12 Inches: Maximum span, 14 feet; minimum rod size, 7/8 inch.

END OF SECTION

SECTION 23 21 14 - HYDRONIC SPECIALTIES

PART 2 PRODUCTS

1.1 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.
5. Thrush Company.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Acceptance Volume Capacity: As indicated on drawings.

C. Maximum Rated Working Pressure: 125 psi.

D. Maximum Allowable Service Temperature: 240 degrees F.

E. 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.

F. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

G. Accessories: Provide air-charging fitting, pressure gauge, and tank drain ball valve.

1.2 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.

1.3 AIR SEPARATORS

A. Centrifugal Air Separators/Strainers:
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. Taco, Inc; _____: www.taco-hvac.com/#sle.
e. Thrush Company.
f. Substitutions: See Section 01 60 00 - Product Requirements.
2. Primed steel body, tested and stamped in accordance with ASME BPVC-VIII-1 with integral bronze strainer, tangential flanged inlet and outlet connections, and internal stainless steel air collector tube.

3. Maximum Service Flow and Pressure: 4,500 gpm at 125 psi.
4. Accessories: Provide epoxy coating finish and tank-bottom magnets.

1.4 STRAINERS

A. Size 2 inch and Under:
1. Provide threaded or grooved brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:
1. Provide flanged or grooved iron body for up to 175 psi working pressure, up to 250 degrees F working temperature, Y-pattern strainer with 1/16 inch or 3/64 inch stainless steel perforated screen.

C. Size 5 inch and Larger:
1. Provide flanged or grooved iron body for up to 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

D. Mesh Screen Size:
1. Water Systems, (Chilled, Condenser & Hot Water): 1/8" perforation
2. Steam Systems: 1/16" perforation

1.5 SUCTION DIFFUSERS

A. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh startup screen, and permanent magnet located in flow stream and removable for cleaning.

B. Class 125:
1. Horizontally or vertically mounted angle-pattern fitting with integral-cast vanes, fine particle mesh screen and magnetic drain plugs for particle removal without disassembly.
2. Maximum Operating Service: 175 psi and 300 degrees F.
3. Sizes, Material, and Connection:
a. 2 inch and Smaller: Cast iron body, threaded.
b. 2-1/2 to 12 inch: Ductile iron body, flanged.

C. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

1.6 PUMP CONNECTORS

A. Flexible Connectors: Flanged, EPDM rubber sphere type with wetted components of stainless steel, sized to match piping.
1. Maximum Operating Service: 150 psi at 120 degrees F.
2. Accommodate the Following:
a. Axial Deflection in Compression and Expansion: _____ inch.
b. Lateral Movement: _____ inch.
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.

1.7 PRESSURE-TEMPERATURE TEST PLUGS

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.

B. Application: Use extended length plugs to clear insulated piping.

1.8 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. Hays Fluid Controls; _____: www.haysfluidcontrols.com/#sle.
5. Taco, Inc; _____: www.taco-hvac.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

B. Size 2 inch and Smaller:
1. Provide ball or globe style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and NPT threaded connections.
2. Metal construction materials consist of bronze or brass.
3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2-1/2 inch and Larger:
1. Provide ball or globe style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and flanged or grooved connections.
2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

1.9 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

1.10 PRESSURE REDUCING VALVES

A. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 23 21 13.

B. Materials of Construction:
1. Valve Body: Constructed of bronze, cast iron, brass, or iron.
2. Internal Components: Construct of stainless steel or brass and engineered plastics or composition material.

C. Connections:
1. NPT threaded: 1/2 inch or 3/4inch.
2. Soldered: 1/2 inch.

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 400 psi.

F. Maximum Fluid Temperature: 180 degrees F.

G. Adjustable Pressure Range: From 10 to 45 psi, set to 25 psi.

PART 3 EXECUTION

2.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide Pressure-Temperature test plugs at inlet and outlet of all hydronic coils.

C. Provide manual air vents at system high points and as indicated.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide pump suction fitting on suction side of base-mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

F. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

G. 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.

H. Pipe relief valve outlet to nearest floor drain.

END OF SECTION

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. End-suction pumps.

1.2 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 09 34 - Variable-Frequency Motor Controllers for HVAC.

C. Section 25 35 00 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

1.3 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.

1.4 SUBMITTALS

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

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

D. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

E.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.

B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.

C. Grundfos Pumps Corporation: www.grundfos.com/#sle.

D. Pentair/Aurora:

E. Taco Comfort Solutions:

F. SIHI Group: www.sterlingsihi.com/#sle.

G. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 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 23 09 34, except for integral-VFDs.
3. Enclosures: Provide unspecified product(s) required to fit motor:

2.3 END-SUCTION PUMPS

A. Split-Coupled Pump: Base-mounted, single-stage pump with horizontal shaft and radially- or horizontally-split casing rated for discharge pressures up to 175 psi.

B. Casing: Cast iron or ductile iron with renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction, and discharge flanged connections with gauge ports.

C. Impeller: Stainless steel, balanced, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical, 225 degrees F maximum continuous duty temperature.

G. Drive: Flexible coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim.

I. Electrical:
1. Motor: 1,750 rpm, open drip-proof (ODP); see Section 23 05 13.
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.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Manufacturer shall certified field alignment after pump installation is complete.

C. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

D. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

E. Provide air cock and drain connection on horizontal pump casings.

F. Controls Human-Machine Interface (HMI): HVAC operator terminal; see Section 25 35 00.

END OF SECTION

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Filter-driers.

1.2 RELATED REQUIREMENTS

A. Section 23 07 16 - HVAC Equipment Insulation.

1.3 REFERENCE STANDARDS

A. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers; 2009.

B. AHRI 711 (SI) - Performance Rating of Liquid-Line Driers; 2009.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

D. 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; 2023.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.

G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

H. ASME B31.9 - Building Services Piping; 2020.

I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

K. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

L. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.4 SUBMITTALS

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

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

B. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

C. Valves:
1. Use service valves on suction and discharge of compressors.

D. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

E. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

2.2 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.

2.3 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

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.

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 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. 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.

2.4 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.5 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.

2.6 VALVES

A. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

B. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

2.7 STRAINERS

A. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.8 FILTER-DRIERS

A. Performance:
1. Flow Capacity - Liquid Line: ____ ton, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).

2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
1. Connections: As specified for applicable pipe type.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 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.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.5.
2. Place hangers within 12 inches of each horizontal elbow.
3. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
4. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
5. Provide copper plated hangers and supports for copper piping.

G. Flood piping system with nitrogen when brazing.

H. Insulate piping and equipment.

I. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

J. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

K. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

L. Fully charge completed system with refrigerant after testing.

M. Provide electrical connection to solenoid valves. See Section 26 05 83.

3.3 FIELD QUALITY CONTROL

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

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test and repair piping until no leakage.

3.4 SCHEDULES

A. Hanger Spacing for Copper Tubing.
1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials.
   1. System cleaner.
   2. Closed system treatment (water).

B. By-pass (pot) feeder.

C. Side-stream filtration equipment.

1.2 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Owner furnished treatment equipment.

1.3 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

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

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

E. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

F. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

G. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Nalco, an Ecolab Company; _____: www.nalco.com/#sle.

B. Earthwise.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 REGULATORY REQUIREMENTS

A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

2.3 CHEMICALS

A. Scale and Corrosion Control
1. Product shall be a solid blend containing scale and corrosion inhibitors.
a. Approved by local water pollution control authorities.
b. Must contain PTSA tracer
2. Furnish chemicals for first year of operation beginning at Owner acceptance.
3. Furnish chemicals in container suitable for use as solution reservoirs.

B. Algae and Biologics Control
1. Provide two separate algaecides for alternate use, (oxidizing and non-oxidizing).
a. Furnish for first year of operation.
b. EPA registered solid blend chemical biocide

2.4 MATERIALS

A. System Cleaner:
1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite or microbiocides such as quarternary ammonia compounds, tributyltin oxide, methylene bis (thiocyanate).

B. Closed System Treatment (Water):
1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

2.5 BY-PASS (POT) FEEDER

A. 6.0 gal quick opening cap for working pressure of 175 psi.

2.6 SIDE-STREAM FILTRATION SYSTEM

A. System: Flow indicator, filter housing with cartridge filter, shut-off valves, and flow control valve.

B. Hot Water Filter Housing: Glass reinforced nylon plastic suitable for 220 degrees F and 200 psi operating conditions.

C. Chilled Water Filter Housing: Reinforced polypropylene plastic housing suitable for 125 degrees F and 125 psi operating conditions.

D. Cartridges: 30 micron for start-up and 5 micron for system operation.

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Hot Water Heating Systems:
   1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
   3. Circulate for 6 hours at design temperatures, then drain.
   4. Refill with clean water and repeat until system cleaner is removed.

C. Chilled Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

D. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect.

E. Flush open systems with clean water for one hour minimum. Drain completely and refill.

F. Remove, clean, and replace strainer screens.

G. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

3.5 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
   1. Provide minimum of two hours of instruction for two people.
   2. Have operation and maintenance data prepared and available for review during training.
   3. Conduct training using actual equipment after treated system has been put into full operation.

3.6 MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. Provide monthly technical service visits to perform field inspections and make water analysis on-site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

D. Provide laboratory and technical assistance services during this maintenance period.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Air plenums and casings.

D. Ducts for kitchen exhaust applications.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 11 40 00 - Foodservice Equipment: Kitchen range hoods.

C. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

D. Section 23 33 00 - Air Duct Accessories.

E. Section 23 33 19 - Duct Silencers.

F. Section 23 36 00 - Air Terminal Units.

G. Section 23 37 00 - Air Outlets and Inlets: Fabric air distribution devices.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

E. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

J. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

K. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

L. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

M. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

N. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

O. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.5 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 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.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 33 19.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range: Refer to Part 3 Duct Pressure and Leakage Class Schedule

E. Duct Sealing and Leakage in accordance with Static Pressure Class: Refer to Part 3 Duct Pressure and Leakage Class Schedule

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.

2.2 METAL DUCTS

A. Material Requirements:
1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Flat-Oval Metal Ducts:
1. Flat-Oval Single Wall Duct: Machine made from a round spiral lock seam duct.
a. Fittings: Manufacture at least two gauges heavier metal than the duct.
b. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
2. Flat-Oval Double Wall Insulated Duct: Machine made from round spiral lock seam duct.
a. Fittings: Manufacture with solid inner wall.
b. Inner Wall: Perforated galvanized steel.
c. Insulation:
1) Thickness: 1 inch fiberglass.

C. Round Metal Ducts:
1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
2. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
a. Insulation:
1) Thickness: 1 inch.
2) Material: Air.
3. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

D. Round Spiral Duct:
1. Round spiral lock seam duct with galvanized steel outer wall.

E. Connectors, Fittings, Sealants, and Miscellaneous:
1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
b. VOC Content: Not more than 250 g/L, excluding water.
c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
4. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.3 FLEXIBLE DUCTS

A. Vapor Barrier Insulated Flexible Air Ducts:
1. UL 181, Class 1, two-ply polyester or vinyl film supported by helically wound spring steel wire.
2. Pressure Rating: From 10 in-wc positive to 1 in-wc negative.
3. Temperature Range: Minus 10 to 160 degrees F.

B. Uninsulated Flexible Air Ducts:
1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
2. Pressure Rating: From 10 in-wc to 1 in-wc negative.
3. Temperature Range: Minus 20 to 210 degrees F.

2.4 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.

B. Minimum Fabrication Requirements:
1. Fabricate acoustic plenum or casing with reinforcing turned inward.
2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
3. Construct panels 3 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
4. Mount floor-mounted plenum or casings on 4-inch high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.

C. Access Doors:
1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
3. Provide clear wire glass observation ports, minimum 6 by 6 inch size.

2.5 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances in accordance with NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Dishwasher Exhaust Duct:
   1. Duct Size: 1 in-wc pressure class stainless steel.
   2. Fabricate using single wall, 20-gauge, 0.035-inch Type 304 stainless steel with external welded joints.
   3. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

F. Kitchen Hood and Grease Exhaust Duct:
   1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
   2. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:
      a. UL Listed and labeled to UL 1978.
      b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.
   3. Zero Clearance, 2-Hour Fire-Rated, Rectangular, Double-Wall, Premanufactured Grease Duct:
      a. Listed when tested in accordance with UL 1978 and ASTM E2336.
      b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.
      c. Liquidtight with continuous external weld for seams and joints.
      d. Where ducts are not self-draining back to equipment, provide low-point drain pocket with copper drain pipe to sanitary sewer.
      e. Through-penetration firestop listed to UL 1479 or ASTM E814.
   4. Grease Exhaust Duct Access Doors:
      a. Listed when tested in accordance with UL 1978.
      b. Install hinged access doors where indicated or required for access for cleaning and inspection of duct.
      c. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Kitchen Range Hoods: Install when provided by Section 11 40 00 then fit-out with respective ductwork and accessories to interconnect exhaust system.

G. Kitchen Hood Exhaust: Provide residue traps at the base of vertical risers with provisions for the cleanout.

H. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use double nuts and lock washers on threaded rod supports.

K. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

L. Louver Fit-out:
1. Provide blank-out panels sealing available area of wall-mounted exterior-faced louver when connected ductwork is smaller than actual louver free area, and duct outlet is smaller than the louver frame.
2. Use the same duct material painted black on the exterior side, then seal louver frame and duct.

M. Fire Partitions: Provide firestopping sealing. See Section 07 84 00.

N. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 23 33 00, 23 36 00, and 23 37 00.

O. Duct Insulation: Provide duct insulation. See Section 23 07 13.

P. Exposed Duct: All exposed duct shall be hard duct, do not install flexible duct where exposed.

3.2 DUCT PRESSURE AND LEAKAGE CLASS SCHEDULE

A. Ducts connected to Fan-coil units, furnaces, heat pumps, and terminal boxes:
1. Pressure Class: 1-inch wg.
2. Minimum SMACNA Seal Class: C.
3. SMACNA Leakage Class for Rectangular: 16.
4. SMACNA Leakage Class for Round and Flat Oval: 8.
5. Minimum gauge thickness for Rectangular: 24 gauge.
6. Duct Leakage and Pressure Test Required: No.

B. Ducts connected to single zone air-handling units, (AHU's that do not have terminal boxes for temperature control):
1. Pressure Class: Positive 3-inch wg.
2. Minimum SMACNA Seal Class: B.
3. SMACNA Leakage Class for Rectangular: 8.
4. SMACNA Leakage Class for Round and Flat Oval: 4.
5. Minimum gauge thickness for Rectangular: 24 gauge.
6. Duct Leakage and Pressure Test Required: No.

C. Ducts connected to air-handling units that use terminal boxes to control airflow and temperature:
1. Pressure Class Supply Ducts: 6-inch wg.
   a. Minimum SMACNA Seal Class: A.
   b. SMACNA Leakage Class for Round and Flat Oval: 2.

c. Rectangular duct is not allowed.
d. Duct Leakage and Pressure Test Required: Yes.

2. Pressure Class Return and/or Exhaust Ducts: 3-inch wg.
   a. Minimum SMACNA Seal Class: B
   b. SMACNA Leakage Class for Rectangular: 8
   c. SMACNA Leakage Class for Round and Flat Oval: 4
   d. Minimum gauge thickness for Rectangular: 24 gauge.
   e. Duct Leakage and Pressure Test Required: No.

D. Ducts connect to light commercial RTU's and ERU's:
   1. Pressure Class Supply, Return and/or Exhaust: 1-inch wg.
   2. Minimum SMACNA Seal Class: C.
   3. SMACNA Leakage Class for Rectangular: 16.
   4. SMACNA Leakage Class for Round and Flat Oval: 16.
   5. Minimum gauge thickness for Rectangular: 24 gauge.
   6. Duct Leakage and Pressure Test Required: No.

E. Ducts connected to Exhaust Fans selected at less than 1.0" TSP:
   1. Pressure Class: Negative 1-inch wg.
   2. Minimum SMACNA Seal Class: C.
   3. SMACNA Leakage Class for Rectangular: 16.
   4. SMACNA Leakage Class for Round: 8.
   5. Minimum gauge thickness for Rectangular: 24 gauge.
   6. Duct Leakage and Pressure Test Required: No.

F. Ducts connected to Exhaust Fans selected greater than 1.0" TSP:
   1. Pressure Class: Negative 3-inch wg.
   2. Minimum SMACNA Seal Class: B.
   3. SMACNA Leakage Class for Rectangular: 8.
   4. SMACNA Leakage Class for Round: 4.
   5. Minimum gauge thickness for Rectangular: 24 gauge.
   6. Duct Leakage and Pressure Test Required: No.

G. Ducts connected to Commercial Kitchen Hoods: Comply with NFPA 96.
   1. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
   2. Concealed: Carbon-steel sheet.
   3. Welded seams and joints.
   4. Pressure Class: Positive or negative 3-inch wg.
   5. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   6. SMACNA Leakage Class: 4.
   7. Duct Leakage and Pressure Test Required: No.

H. Ducts connected to Dishwasher Exhaust Systems:
   1. Type 304, stainless-steel sheet.
   2. Exposed to View: No. 4 finish.
   3. Concealed: No. 2D finish.
   4. Welded seams and flanged joints with watertight EPDM gaskets.
   5. Pressure Class: Positive or negative 2-inch wg.
   6. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
   7. SMACNA Leakage Class for Rectangular: 16
   8. SMACNA Leakage Class for Round: 6.
   9. Duct Leakage and Pressure Test Required: No.

I. Ducts connected to Fume Hoods:
   1. Type 316, stainless-steel sheet.

a. Exposed to View: No. 4 finish.
b. Concealed: No. 2B finish.

2. Pressure Class: Positive or negative 4-inch wg.
3. Minimum SMACNA Seal Class: A.
4. SMACNA Leakage Class: 2.
5. Duct Leakage and Pressure Test Required: No.

3.3 DUCT LEAKAGE & PRESSURE TESTING

A. Where required by the Duct Pressure and Leakage Class Schedule, duct system shall be tested in accordance with the following requirements.

1. Test complete system at a minimum of 6.0" WC or the listed pressure class, which ever is greater. The maximum allowable leakage for the system shall be 1% of the total design airflow.
2. The mechanical contractor shall perform the duct leakage test and shall provide equipment necessary for performing the test including a certified orifice section and calibration paperwork. All test readings shall be converted to CFM leakage according to the certified orifice's calibration paperwork, and the TAB contractor shall calculate the resulting leakage percentage to determine whether the system passes or fails.
3. The ductwork shall be tested from source (supply fan) all the way to the connected devices (just upstream of VAV, FVAV, etc…). All duct taps, runouts, fire dampers, fire smoke dampers, etc… included in this run shall be installed at the time of the test, and the test shall run through these items.
4. Where large duct systems are tested in sections, the entirety of the system will not be considered passing until all portions are tested, the results are summed, and the total leakage of the entire system is calculated and determined to be passing.
5. All pressure tests shall be witnessed by the owner's representative, design team, and test and balancing (TAB) firm. If the design team and owner's representative cannot be present for the testing, the TAB firm must be present and pictures of ducts being tested, devices being used for testing, pictures of the orifice and its associated calibration paperwork must be taken.
6. Submit results of duct pressure tests along with confirmation of passing to the engineer of record, owner, and commissioning agent.

END OF SECTION

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Combination fire and smoke dampers.

B. Duct access doors.

C. Duct test holes.

D. Fire dampers.

E. Flexible duct connectors.

F. Smoke dampers.

G. Volume control dampers.

H. Low leakage (Class 1A) control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 92 - Standard for Smoke Control Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

F. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.

G. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:
1. Arrow United Industries, www.arrowunited.com.
2. Greenheck, www.greenheck.com.
3. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
4. Nailor Industries, Inc: www.nailor.com/#sle.
5. Pottorff: www.pottorff.com/#sle.
6. Ruskin Company: www.ruskin.com/#sle.
7. United Enertech: www.unitedenertech.com/#sle.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Ratings:
1. Fire Resistance: Damper shall match wall ratings (1.5-hrs or 3-hrs), refer to architectural plans for wall ratings.
2. Fire Closure Temperature: 165 degree F.Each combination fire-smoke damper shall be equipped with a factory installed heat responsive device rated to close the damper when the temperature at the damper reaches 165 degree F.
3. Elevated Operational Temperature: Dampers shall have a UL 555S elevated temperature rating of 250°F.

D. Construction:
1. Frame: Damper frame shall be 16 ga. galvanized steel formed into a 5 in. x 1 in. structural hat channel. Dampers less than 17 in. high shall utilize low profile geometry and 20 ga. galvanized steel for the top and bottom frame members to maximize free area. Frame shall be 4-piece construction with 1 ½ in. (minimum) integral overlapping gusset reinforcements in each corner to assure square corners and provide maximum resistance to racking. No welding of damper frames shall be permitted.
2. Seals:
   a. Blade Edge: Blade seals shall be extruded silicone rubber mechanically secured to the appropriate blade edges
   b. Jamb: Flexible stainless steel compression type.
3. Linkage: Blade linkages shall be non-adjustable and concealed within the jamb of the damper.
4. Axles: Minimum ½ inch dia. zinc plated steel.
5. Sleeves: Damper shall be supplied as a single assembly with a factory installed sleeve made of material matching that of the damper.
6. Fire Closure Device: Reusable Resettable Link.Mounting: Horizontal or Vertical, refer to plans for requirements.
7. Finish: Galvanized steel.
8. Actuators:
   a. Electric, 120V, 2-position.
   b. Mounting Location: External (outside of duct).
9. Retaining Angles: 1 ½” x 1 ¼” or 2 ½” x 1 ½”.

E. Differential Pressure: Dampers shall have a UL 555S differential pressure rating of 4 in. wg.

F. Requirements for Fire and Smoke Dampers installed in Medium Pressure Systems:
1. Performance:
a. Pressure Drop: The Damper manufacturer's submittal data shall certify that all pressure drop data is licensed in accordance with the AMCA Certified Ratings Program for Test Figures 5.2, 5.3, and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D. Dampers shall be labeled with the AMCA Air Performance Seal. AMCA certified pressure drop for a 24 in. wide x 24 in. high damper shall not exceed 0.06 in. wg when subjected to an airflow velocity of 1500 fpm according to AMCA Test Figure 5.3.
b. Leakage: Dampers shall have a UL555S leakage rating of Leakage Class I. (8 cfm/ft2 (0.04 m3/ s/m2) at 4 in. wg (1.0 kPa).
2. Blades: Damper blades shall be of 14 ga. equivalent, galvanized steel with full length structural reinforcement and a double skin true airfoil shape. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
3. Velocity: Dampers shall have a UL 555S velocity rating of 4000 fpm.

G. Requirements for Fire and Smoke Dampers installed in Low Velocity Systems:
1. Performance:
a. Pressure Drop: The damper manufacturer's submittal data shall certify that all pressure drop data is licensed in accordance with the AMCA Certified Ratings Program for Test Figures 5.2, 5.3, and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D. Dampers shall be labeled with the AMCA Air Performance Seal. AMCA certified pressure drop for a 24 in. wide x 24 in. high damper shall not exceed 0.09 in. wg when subjected to an airflow velocity of 1500 fpm according to AMCA Test Figure 5.3.
b. Leakage: Dampers shall have a UL555S leakage rating of Leakage Class II. (20 cfm/ft2 at 4 in. wg).
2. Blades: Damper blades shall be 16 ga. galvanized steel strengthened by three longitudinal 1 in. deep V-grooves running the entire length of each blade. Each blade shall be symmetrical relative to its axle pivot point, presenting identical performance characteristics with air flowing in either direction through the damper. Provide symmetrical blades of varying size as required to completely fill the damper opening.
3. Velocity: Dampers shall have a UL 555S velocity rating of 2000 fpm.

2.2 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.3 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.4 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Ceiling (Radiation) Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame and 16-gauge, 0.0598-inch flap, two layers of 0.125-inch thick ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
   1. Boot Fitting: Factory-provided el type (90 degree). Include field-provided collar.
   2. Rated for one hour service in compliance with UL 555C.

C. Horizontal Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame, stainless steel closure spring, and lightweight, heat-retardant, non-asbestos fabric blanket.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.

E. Multiple Blade Dampers: 16-gauge, 0.0598-inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.5 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.6 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by electric actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.7 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gauge, 0.0239 inch, minimum.

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.
   1. Blade: 18 gauge, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. Where rod lengths exceed 30 inches provide regulator at both ends.

2.8 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

A. Manufacturers:
1. Ruskin Company; CD50: www.ruskin.com/#sle.
2. United Enertech; _____: www.unitedenertech.com/#sle.
3. Greenheck, www.greenheck.com.

B. Maximum Leakage Allowed: 3 cfm/sq ft at 1 in-wc.

C. Frame:
1. Material: 20-gauge galvanized steel.

D. Blade:
1. Type: Multi-blade extruded airfoil for high pressure.
2. Operation: Opposed type.

E. Other Requirements:
1. Paint Finish: Standard.
2. Sleeve or Flange: Factory-mounted standard.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.

B. Provide duct test holes where indicated and required for testing and balancing purposes.

C. 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.

D. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

E. Demonstrate re-setting of fire dampers to Owner's representative.

F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Cabinet exhaust fans.

C. Upblast roof exhausters.

D. Kitchen hood upblast roof exhausters.

E. Laboratory-fume exhaust fans.

1.2 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 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 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022, with Editorial Revision (2023).

F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating; 2020.

G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.

J. ANSI Z9.5 - Laboratory Ventilation; 2022.

K. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

L. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

M. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

1.5 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Greenheck Fan Corporation: www.greenheck.com/#sle.

C. Loren Cook Company: www.lorencook.com/#sle.

D. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.

E. Twin City Fan & Blower: www.tcf.com/#sle.

2.2 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.

F. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.3 ROOF EXHAUSTERS

A. Fan Unit: Direct driven unless otherwise noted, 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.

B. Fan Motor:

1. ECM (Electrically Commutated Motor): Brushless DC controlled by an integrated controller/inverter that operates the wound stator and senses rotor position to electrically commutate the stator. Motor shall be provided with manual speed controller and shall also accept a 0-10V speed signal for speed control from BAS contractor.

C. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

D. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor.

E. Backdraft Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

F. Sheaves: When required, 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.

G. Performance Ratings: As indicated on drawings.

2.4 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.

B. Grille: Molded white plastic.

C. 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.

D. Performance Ratings: As indicated on drawings.

2.5 UPBLAST ROOF EXHAUSTERS

A. Belt Drive Fan:
1. Fan Wheel:
   a. Type: Non-overloading, backward inclined centrifugal.
   b. Material: Aluminum, statically and dynamically balanced.
2. Housing:
   a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
   b. Rigid internal support structure.
   c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
   d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
   e. Provide breather tube for fresh air motor cooling and wiring.

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. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

D. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

E. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:
1. Dampers: Provide motorized type.
2. Grease Trap: Required on Kitchen Exhaust fans only.
a. Container system to collect grease residue.
3. Hinge Kit: Required on Kitchen Exhaust fans only.
a. Allows fan to tilt away for access to wheel and ductwork for inspection and cleaning.
4. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.

H. Performance Ratings: As indicated on drawings.

2.6 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:
1. Fan Wheel:
a. Type: Non-overloading, backward inclined centrifugal.
b. Material: Aluminum, statically and dynamically balanced.
2. Housing:
a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
b. Rigid internal support structure.
c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
e. Provide breather tube for fresh air motor cooling and wiring.

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. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

D. Disconnect Switches:
1. Factory mounted and wired in NEMA 3R Encloseure.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

E. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:
1. Birdscreen:
2. Roof Curb Extension: Vented curb extension where required for compliance with minimum clearances required by NFPA 96.
3. Grease Trap:
   a. Container system to collect grease residue.
   b. Maintain 40" height from roof surface to discharge of fan.
4. Hinge Kit:
   a. Hinges and restraint cables mounted to base sleeve.
5. Tie-down Points: Four brackets located on windband secures fan in heavy wind applications.

H. Performance Ratings: As indicated on drawings.

2.7 LABORATORY FUME-EXHAUST FANS

A. Manufacturers:
1. Greenheck Fan Corporation; _____: www.greenheck.com/#sle.
2. Loren Cook Company; _____: www.lorencook.com/#sle.
3. Twin City Fan & Blower; TVIFE: www.tcf.com/#sle.

B. General Requirements:
1. Fan Type: Roof-curb mounted, constant stack-velocity discharge laboratory exhaust.

2. Minimum air discharge velocity of 3,000 fpm in compliance with ANSI Z9.5.
3. Provide fan-assembly manufactured to sustain structural integrity without external guy-wires or supplemental supports at wind speeds up to 125 mph.
4. Fan performance tested in accordance with AMCA 210, AMCA 260, and AMCA 300.
5. Fan performance ratings certified in accordance with AMCA 211 and AMCA 311.

C. Application:
1. Dedicated Fume Hood Exhaust:
   a. Fan Type: Direct-driven, single-speed motor with epoxy-based protective coating.
   b. Exhaust Capacity: Select fan to handle full exhaust airflow rate, system static pressure loss with 15 percent load-capacity factor, and minimum discharge plume height of 10 feet above roof level.

D. Fan Section Requirements:
1. Impeller:
   a. Non-overloading, backward-inclined centrifugal.
   b. Material: Aluminum.
2. Fan Shaft:
   a. Ground and polished steel with anticorrosive coating.
   b. First critical speed at least 25 percent over maximum cataloged operating speed.
   c. Enclosed over OSHA recommended safety-yellow painted guards.
3. Bearings:
   a. 100 percent factory tested surface-mounted bearings outside of the airstream.
   b. Operate during a minimum L10 service life in excess of 100,000 hours at maximum cataloged operating speed.
4. Housing:
   a. Construct of heavy gauge aluminum with standard factory finish.
   b. Mounting Base:
      1) External mounting base with lifting lugs.
   c. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
   d. Provide breather tube for fresh air motor cooling and wiring.
   e. Minimum Assembly Height: 120 inches above the roof surface.
5. Isolation Damper:
   a. With parallel blade damper, constructed of matching materials and finish.
   b. Provided by manufacturer, bolted to access drawer or panel for easy removal from contaminated airstream.
   c. With two-position damper actuator:
      1) Provided by manufacturer.
      2) Operate interlocked with fan starter.
      3) With integral auxiliary switches to monitor blade position status.
      4) Rated for NEMA EN 10250, Type 4 (IP66) environment within protective weather-housing out of contaminated airstream, connected through linkages.
6. Fan Discharge Outlet-Nozzle:
   a. High Plume: Conical shaped nozzle manufactured to facilitate attaining a required air-discharge velocity of constantly to lightly reduced exhaust flows.
7. Fan Inlet Flow Sensor: Provide factory-mounted pitot tube-based differential pressure sensor probe ready for use by TAB to balance fan.

E. Fan Bypass Air Plenum:
1. Constant Volume Systems: For constant volume systems, the fan shall be connected directly to the exhaust duct without the need of a bypass air plenum. Fans mounted directly to roof curbs shall be provided with a damper tray located in the roof curb for mounting of the gravity isolation damper.

2. Variable Volume Systems: For variable volume systems, a bypass air plenum shall be provided as shown on drawings. The plenum shall be equipped with a bypass air damper and intake air hood with bird screen for introducing outside air at roof level upstream of the fan.

F. Disconnect Switch:
1. Factory-mounted in NEMA EN 10250, Type 3R box wired in compliance with Section 26 05 83.
2. Switchbox Finish: Manufacturer's standard unless otherwise indicated.

G. Roof Curbs:
1. 12 inch high, self-flashing of matching material and finish with continuously welded seams.
2. Provide integral formed steel support framework with curb cap guides.

H. Performance Ratings: As indicated on drawings.

PART 3 EXECUTION

3.1 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

SECTION 23 34 39 - HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High-volume, low-speed propeller fans.

1.2 REFERENCE STANDARDS

A. UL 507 - Electric Fans; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Manufacturer's Instructions: Indicate installation instructions.

1.4 WARRANTY

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

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 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.

2.2 HIGH-VOLUME, LOW-SPEED PROPELLER FANS

A. Manufacturers:
1. Big Ass Fans; Essence: www.bigassfans.com/#sle.

B. Performance Ratings: Refer to drawing schedule.

C. 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.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure fan with stainless steel lag screws to structure.

END OF SECTION

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fan-powered units.

1.2 RELATED REQUIREMENTS

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC.

B. Section 23 31 00 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ASHRAE Std 130 - Laboratory Methods of Testing Air Terminal Units; 2016.

D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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

I. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of the second through sixth-octave bands at inlet static pressures of 1 to 4 in-wc.

D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

PART 2 PRODUCTS

2.1 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

A. Manufacturers:
1. Krueger-HVAC; _____: www.krueger-hvac.com/#sle.
2. Metalaire, a brand of Metal Industries Inc; _____: www.metalaire.com/#sle.
3. Price Industries, Inc; _____: www.priceindustries.com/#sle.
4. Nailor Industries

B. Basis of Design: Price Industries, Inc: www.priceindustries.com/#sle.
1. Single-Duct Terminal Unit: SDV, (direct digital controls).
2. Single-Duct Terminal Units for Electric Coils: SDV-EC, (electric heating coil with direct digital controls).

C. General:
1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

D. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
a. Casing leakage to meet ASHRAE Std 130.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

E. Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

F. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
2. Coil Casing: 20 gauge, 0.0359 inch galvanized steel.
3. Heating Elements: Nickel chrome, supported by ceramic insulators.
4. Integral Control Panel: NEMA EN 10250, Type 2 enclosure with hinged access door for access to all controls and safety devices.

5. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.
6. Provide the following additional components, mounted and/or wired within the control enclosure:
   a. Fused or non-fused door interlocking disconnect switch.
   b. Mercury contactors.
   c. Fuse block.
7. Factory wired, including all limit switches and steps of control as indicated on the equipment schedule, with the SSR (solid-state relay) proportional heat control.
8. Provide SCR (Silicon Controlled Rectifier) controller.

G. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

H. Factory Mounted and Wired Controls:
1. Control Transformers: Factory supplied and mounted for electric and electronic control applications.
2. Wiring Terminations: Fan controls to terminal strip. Terminal lugs to match quantites, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
3. Disconnect Switch: Factory-mounted, fuse type.

I. Controls:

2.2 FAN-POWERED SERIES UNITS

A. Manufacturers:
1. Krueger-HVAC; _____: www.krueger-hvac.com/#sle.
2. Metalaire, a brand of Metal Industries Inc; _____: www.metalaire.com/#sle.
3. Price Industries, Inc; _____: www.priceindustries.com/#sle.
4. Nailor Industries

B. Basis of Design: Price Industries, Inc: www.priceindustries.com/#sle.
1. Constant-Volume Series Fan-Powered Unit: FDC, (direct digital controls).

C. General:
1. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.

D. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, suitable for flanged duct connection.
4. Acceptable Liners:
   a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.

E. Primary Air Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid shaft rotating in bearings.

2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak (2 percent) damper blades for tight airflow shutoff.
4. Fan(s): Forward curved, centrifugal type.
5. Fan Motor:
   a. ECM (Electrically Commutated Motor):
      1) Brushless DC controlled by an integrated controller/inverter that operates the wound stator and senses rotor position to electrically commutate the stator.
   b. Fan motor shaft directly connected to fan and isolated from unit casing to prevent transmission of vibration.

F. Electric Heating Coil:
1. Listed and provided by the terminal unit manufacturer.
2. Coil Casing: Minimum 20 gauge, 0.0359 inch galvanized steel.
3. Heating Elements: Open wire, nickel chrome, supported by ceramic insulators.
4. Integral Control Panel: NEMA EN 10250, Type 2 enclosure, with hinged access door for access to all controls and safety devices.
5. Provide a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow or electrical interlock to prevent heater operation when fan is not running.
6. Provide the following additional components, mounted and/or wired within the control enclosure:
   a. Fused or non-fused door interlocking disconnect switch.
   b. Mercury contactors.
   c. Fuse block.
7. Provide SCR (Silicon Controlled Rectifier) controller.

G. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

H. Controls:
1. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
   a. Signal accuracy: Plus/minus five percent throughout terminal operating range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 23 31 00.

END OF SECTION

SECTION 23 38 13.01 - RESIDENTIAL-KITCHEN RANGE HOOD FOR COMMERCIAL BUILDINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Residential Kitchen Range Hoods.

1.2 RELATED REQUIREMENTS

A. Section 11 2013: Residential Appliances.

1.3 REFERENCE STANDARDS

A. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

B. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL (DIR) - Online Certifications Directory; Current Edition.

F. UL 507 - Electric Fans; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data: Manufacturer's data indicating dimensions, capacity, operating features of the Hood, and installation instructions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electrical Applianes: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.6 WARRANTY

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

B. Submit a written warranty, executed by the Manufacturer, agreeing to repair or replace equipment that fails in materials or workmanship within the specified warranty period.
   1. Warranty Period: One (1) year after date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Accurex, LLC: www.accurex.com.

B. Deniar Fire Protection: www.denlarhoods.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 HOOD REQUIREMENTS

A. Fully integrated, self-contained fire suppression range hood for residential appliances for use in protecting residential-grade appliances when used din public or otherwise commercial spaces.

B. General
1. NFPA 101 compliant, provide with:
a. 500 CFM factory-supplied integral fan.
b. Locked (password protected) appliance disconnect with timed-automatic range deactivation.
c. Manual pull station.
2. Kitchen ventilation hood shall be exhaust only, and cover a domestic range sizes 30” in commercial environments used for domestic purposes only.
3. ICC evaluated and certified as compliant with ICC (IMC), ICC (IFC), and IAPMO (UMC).
4. Fan shall be UL 507 listed or equivalent.
5. Hood fire suppression shall be UL listed to the UL Subject 300A.
6. Hood shall be configured as wall style (supplied with wall mounting bracket).
7. Integral fan options include either front recirculating or rear discharge. Front recirculating style shall include an easily accessible charcoal filter and opening in the front of the hood for filtering the exhaust air before discharging back into the space. Rear discharge shall direct the air to exit the back of the hood, to discharge through a wall to the outside. External fan options include either a factory-provided inline fan (with plug and play cable) or fan by others option with a top discharge hood configuration. Top discharge shall direct the air to exit the top of the hood, to discharge through a roof or wall to the outside All factory provided fan options shall include energy efficient electrically commutated motors (ECM) standard.

C. Hood Construction:
1. Construct of 18 gauge minimum, 300 series stainless steel outer shell.
2. Hood shall be either 30” long (to cover 30” range) or 36” long (to cover 36” range).
3. Hood shell shall be manufactured and assembled with no visible outer welds or weld marks. All internal seams shall be sealed with NSF-approved caulk.
4. Provide with a metal mesh filter.
5. Two (2) 2200-2700K color LED recessed hood lights shall provide over 50 foot-candles of evenly-dispersed lighting on the range below.

D. Fire Suppression System:
1. Factory-installed UL Subject 300A fire suppression system, including fully monitored electronic detection and actuation. Braided cable or fusible links shall be accepted.
2. Fire suppression shall consist of two (2) mounted metal-housed temperature sensors that monitor the cooking surface and upon reaching set-point, send a signal back to the main fire system control board, which activates the tank solenoid valve and expels the wet chemical from a pre-charged tank responsible for suppressing the fire. Tank pressure shall be monitored using tank pressure sensor and a fault must be displayed on the user interface if low pressure is detected.

3. Fire suppression and control components must be easily accessible by dropping the hood into a service position to allow for service without removing the hood. Latches shall be utilized to hold the hood into place for normal operation.
4. Include either an electronic or gas shut off device that shall be field connected back to the hood via factory-provided plug and play cables. Prior to fire suppression release, the shut off device shall be responsible for disabling the range upon detecting a high temperature. Gas disconnect (if provided) shall include a ¾" gas valve supplied with plug and play cable and a 115VAC control receptacle. Electric disconnect (if provided) shall include a 4-prong 250VAC 50A power receptacle. Other electric disconnect receptacle types are also available upon special request.

E. Hood Operation:
1. User interface can be utilized to turn on and off fans, lights, and range disconnect.
2. If configured for NFPA 101 life safety code, password entry will be required to engage disconnect. After range is turned on, count down timer will begin, and upon expiring will disengage the range disconnect.
3. Upon reaching specific set-point, exhaust fan will engage automatically if not already turned on and be forced to a speed based on a temperature range.
4. Upon reaching a second higher temperature set-point, the disconnect will be automatically shut off and a warning will appear on the user interface.
5. Upon reaching a preset temperature, the fire system will engage and discharge wet chemical on top of the range.

F. Accessories:
1. User Interface:
   a. User interface shall be provided to control fan, range, and lights and view system statuses, including faults/alarms.
   b. Full color 4.3" LCD touch screen. No toggle switches or rheostats shall be acceptable.All factory and configuration settings must be accessed by touchscreen through password-protected entry. For ADA compliance, the user interface can be shipped loose to be field mounted on a wall near the hood. If shipped loose, user interface shall be provided with factory supplied plug and play cable.
   c. Factory and configuration settings must be accessed by touchscreen through password-protected entry.
   d. ADA complianet, the user interface can be shipped loose to be field mounted on a wall near the hood. If shipped loose, user interface shall be provided with factory supplied plug and play cable.
2. Horn strobe, with plug and play cable.
3. K-class 6 liter wet chemical fire extinguisher.
4. Manual pull station, with plug and play cable.
5. Dry contacts are provided standard for tie into building alarm systems and supply fan integration.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Anchor built-in equipment in place.

3.3 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.4 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

SECTION 23 38 13 - COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cooking hoods.

B. Condensate (dishwashing) hoods.

1.2 DEFINITIONS

A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.

B. Standard Hood: A hood, usually field fabricated, that complies with design, construction, and performance criteria of applicable national and local codes.

C. Type I Hood: A hood designed for grease exhaust applications.

D. Type II Hood: A hood designed for heat and steam removal and for other nongrease applications.

1.3 SUBMITTALS

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

B. Product Data: For the following:
1. Standard hoods.
2. Filters/baffles.
3. Fire-suppression systems.
4. Lighting fixtures.

C. Shop Drawings: Signed and sealed by a qualified professional engineer.
1. Shop Drawing Scale: 1/4 inch = 1 foot .
2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.
4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Project-site elevation.
5. Show control cabinets.
6. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
7. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
8. Wiring Diagrams: Power, signal, and control wiring.
9. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
    a. Piping Diagram Scale: 1/4 inch = 1 foot .

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.5 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

PART 2 PRODUCTS

2.1 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.
   1. Minimum Thickness:
   2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
      a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
   3. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
   4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR, Section 17 7.2600, for use in areas that come in contact with food.
   1. Color: As selected by Architect from manufacturer's full range.
   2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

C. Sound Dampening: NSF-certified, nonabsorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.

D. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.2 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
   1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
   2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
   3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
   4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
   5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets, unless otherwise indicated.

J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

K. Fabricate enclosure panels to ceiling and wall as follows:
1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
2. Wall Offset Spacer: Minimum of 3 inches.

2.3 TYPE I EXHAUST HOOD FABRICATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Accurex.
2. Avtec.
3. Halton Company.
4. Moduserve.

B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Duct Collars: Minimum 0.0598-inch- thick steel at least 3 inches long, continuously welded to top of hood and at corners.

C. Hood Configuration: Exhaust only, (make up air will be supplied directly to the kitchen).

D. Hood Style: Wall-mounted canopy.

E. Filters/Baffles: Removable, stainless-steel. Fabricate stainless steel for filter frame and removable collection cup and pitched trough. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles shall be tested according to UL 1046, "Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.

F. Lighting Fixtures: Surface-mounted, fluorescent fixtures and lamps with lenses sealed vapor-tight. Wiring shall be installed in conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.
1. Light switches shall be mounted on front panel of hood canopy.
2. Lighting Fixtures: Fluorescent with Super T8 light and matching balance complying with UL 1598.

G. Hood Ventilation Controls Systems
1. Refer to specification section 23 0930 – KITCHEN HOOD VENTILATION CONTROL SYSTEM for requirements of the variable flow ventilation control system.

H. Wet-Chemical Fire-Suppression System
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Ansul Incorporated; a Tyco International Ltd. Company.
   b. Kidde Fire Systems.
   c. Pyro Chem.
2. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.
   a. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends, chrome plated.
   b. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
   c. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
   d. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
   e. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
      1) Valve shall close on loss of power.
      2) Valve shall automatically reset on return of power in non-alarm conditions.
   f. Fire-suppression system controls shall be integrated with controls for fans, and fuel supply. Suppression control system and extinguishing agents shall be located in one common single stainless-steel cabinet, (refer to plans for actual location) cabinet shall be as required.
   g. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm and wiring to start fan with fire alarm.

2.4 TYPE II EXHAUST HOOD

A. Condensate Hoods: Provide Type II hoods with all joints and seams liquid-tight.
1. Inside the bottom perimeter provide an integral formed condensate gutter:
2. Gutter Dimensions: 3 inches wide with one inch flange turned up at 45 degree angle.

3. Drain: Stainless steel, one inch diameter, located in back corner of gutter.
4. Pipe drain to nearest sink drainboard or floor drain.

B. Dishwashing Machine Hoods Type II: Custom-fabricated condensate hood to fit machine.
1. Make-up and exhaust ducts extending 6 inches above ceiling for connection by others.
2. Hood Configuration and Size: As indicated on drawings.

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.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

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

3.2 INSTALLATION

A. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

B. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners, unless otherwise indicated.

C. Install hoods to operate free from vibration.

D. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

E. Install sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

F. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

G. Set initial temperatures, and calibrate sensors.

H. Set field-adjustable switches.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect ducts according to requirements in Division 23 Section "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.

C. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:
   1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
   4. Perform hood performance tests required by authorities having jurisdiction.
   5. Perform fire-suppression system performance tests required by authorities having jurisdiction.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 23 51 00 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Type B double wall gas vents.

B. Double wall metal stacks.

C. Special gas venting.

1.2 REFERENCE STANDARDS

A. ANSI Z21.66 - American National Standard for Automatic Damper Devices for Use with Gas-Fired Appliances; 2015 (Reaffirmed 2020).

B. NFPA 54 - National Fuel Gas Code; 2021.

C. NFPA 82 - Standard on Incinerators and Waste and Linen Handling Systems and Equipment; 2019.

D. UL 441 - Standard for Gas Vents; Current Edition, Including All Revisions.

E. UL 1738 - Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV; Current Edition.

1.3 DEFINITIONS

A. Breeching: Vent connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

D. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 SUBMITTALS

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

B. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

C. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory-built units are used.

D. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

E. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Breechings, Chimneys, and Stacks:
1. DuraVent; DuraStack Pro (DIS2): www.duravent.com/#sle.
2. Metal-Fab, Inc; _____: www.mtlfab.com/#sle.
3. Security Chimneys International; Secure Stack Pro (CIX2): www.securitychimneys.com/#sle.
4. Z-Flex U.S. Inc; _____: www.z-flex.com/#sle.

2.2 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS

2.3 TYPE B DOUBLE WALL GAS VENTS

A. Fabrication: Inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, tested in compliance with UL 441.

B. Electrically Actuated Vent Dampers: Same size as draft hood collar, constructed of stainless steel or galvanized steel, with corrosion-resistant components, in compliance with ANSI Z21.66.

2.4 SPECIAL GAS VENTING (CATEGORY II, III, AND IV)

A. Double-Wall Special Gas Venting:
1. Provide double-wall metal stacks, tested to UL 1738 and UL listed with positive pressure rating for use with building heating equipment; comply with NFPA 54.
2. Fabricate with 1-inch minimum air space between walls and construct inner liner of 28-gauge, 0.015-inch 29-4C stainless steel minimum and outer jacket of 24 gauge, 0.025-inch stainless steel minimum.
   a. Protect aluminized steel surfaces exposed to elements with minimum of one base coat of primer and one finish coat of corrosion-resistant paint suitable for outer jacket skin temperatures of application.
3. Design, fabricate, and install gastight to prevent products of combustion from leaking into building. Securely connect inner joints and seal in accordance with manufacturer's instructions.
4. Accessories, UL Labeled:
   a. Ventilated Roof Thimble: Consists of roof penetration, vent flashing with spacers, and storm collar.
   b. Exit Cone: Consists of inner cone and outer jacket to increase stack exit velocity 1.5 times.
   c. Rain/Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. For Type B, double-wall gas vents, maintain UL-listed minimum clearances from combustibles. Assemble pipe and accessories as required for complete installation.

C. Assemble and install stack sections in accordance with NFPA 82, UL Listings, and industry practices. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

D. Level and plumb chimney and stacks.

3.2 SCHEDULES

A. Breechings, Chimneys and Stacks.
1. Boiler: Steel breeching, Type II chimney.

END OF SECTION

SECTION 23 52 16 - CONDENSING BOILERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.2 RELATED REQUIREMENTS

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

B. Section 25 15 00 - Integrated Automation Software.

1.3 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.

B. NFPA 54 - National Fuel Gas Code; 2021.

1.4 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Verification that Contract Documents are in accordance with manufacturer recommendations:
1. Include with submittal copy of contract documents Hot Water Piping Schematic. Note any modifications required to operate boiler per manufacturer recommendations.
2. Include with submittal copy of Section 230993 - Sequence of Operations for HVAC. Confirm Sequence of Operations are acceptable to manufacturer, note any required modifications to ensure boiler(s) operate in a manor acceptable to the manufacturer.

D. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 WARRANTY

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

B. Provide warranty as follows:
1. Heat Exchanger: 10-year
2. Burner: 5-year
3. All other Components: 1-year

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Modular Condensing Hot Water Boiler for Indoor Applications:
1. Camus Hydronics.
2. Raypak.
3. Viessmann.

2.2 MANUFACTURED UNITS

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. Description: Factory-fabricated, -assembled, and -tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only.

D. Heat Exchanger: Configuration shall be a cylindrical, vertical, two-pass, counter-flow, fire tube design and consist of an integral combustion chamber with an inner tube bundle for primary heat transfer and an outer tube bundle for extracting latent heat from flue gases. The combustion chamber, fire tubes, and tube sheets shall be constructed of 316L stainless steel. The remainder of the heat exchanger shall be constructed of 304L stainless steel. The fire tubes shall be of an oval design with a minimum wall thickness of 0.061”. The upper and lower tube sheets shall have a thickness of no less than 0.25”. The heat exchanger design shall be capable of 40^{o}F constant system return temperatures and be fully condensing complete with condensate trap and drains.

E. Combustion Chamber: The combustion chamber shall be an all welded stainless-steel construction and an integral part of the heat exchanger. The combustion chamber shall incorporate an easily removable radial fired knitted fiber stainless steel burner to access the internal combustion chamber for inspection, service, and cleaning. A window view port shall be provided for visual inspection of the boiler combustion during firing.

F. Burner: The burner shall be a 100% stainless steel vertical mounted radial fired type with stainless knitted metal fiber construction. The burner shall combust a precise amount of premixed combustion air and gas to provide equal distribution of heat for heat transfer throughout the entire heat exchanger. Combustion products are exhausted under minimum back pressure Combustion operates with a minimum 22:1 turn down ratio while sustaining combustion characteristics throughout the entire modulating range. Operation of up to 99% thermal efficiency and shall be certified for Oxides of Nitrogen (NOx) of 9 ppm corrected to 3% oxygen.

G. Blower: Centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.

H. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

I. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

J. Gas Train: The gas train shall consist of a pressure regulating electro-hydraulic proportional air/gas main gas actuator providing a slow opening, fast closing shutoff valve and proportional 1:1 air/gas ratio control, a fast closing safety shutoff gas pressure regulator with 1/2 PSI allowable static pressure, a low gas pressure switch, and a high gas pressure switch. A factory pre-set combination metering valve and orifice shall be provided for setting combustion parameters.

K. Ignition: The ignition module shall employ a direct igniter with 3 tries for ignition followed by lockout. Ignition control shall include times for pre-purge, pre-ignition, ignition, and post purge.

L. Casing:

M. Jacket: External Jacket shall be 430 stainless steel mirror finish panels and a power coated access top cover.

N. Control Compartment Enclosures: NEMA 250, Type 1A.

O. Finish: 430 stainless steel mirror finish.

P. Insulation: Minimum 2-inch- thick, mineral-fiber insulation surrounding the heat exchanger.

Q. Combustion-Air Connections: Inlet and vent duct collars.

R. Mounting base to secure boiler.

S. Characteristics and Capacities: Refer to drawing schedules.

2.3 BOILER TRIM

A. Include devices sized to comply with ANSI B31.1, "Power Piping."

B. Aquastat Controllers: Operating and high limit.

C. Safety Relief Valve: ASME rated.

D. Pressure and Temperature Gage: Minimum 3-1/2-inch- diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

E. Boiler Air Vent: Manual.

F. Drain Valve: Minimum NPS 3/4 hose-end gate valve.

2.4 CONTROLS

A. Boilers shall be provided with controls package that will operate all boilers as a common system. BAS contractor will provide boiler control system with a start and stop signal only, the boilers own controls shall preform the following functions:
1. Determine discharge water temperature based on OA temp and inverse reset schedule. The reset schedule shall be adjustable from a common boiler control panel.
   a. Boiler manufacture shall provide and install exterior temperature sensor(s). Temperature sensor shall be located in adjacent exterior area way. Control wiring from sensor to boiler shall be installed in conduit.
   b. OA reset shall be as follows:
      1) OA temp above 60F: Hot water supply temp = 100F
      2) OA temp below 32F: Hot water supply temp = 130F
      3) OA temp between 60F & 32F: Reset Lineraly
2. Determine individual boiler operation dependent on building load and flow.
3. Rotate boilers on a lead/lag basis to equalize run time among boilers.
4. Start/stop boilers individual primary water pumps based on building load and operations.
5. Boiler manufacture shall provide all hydronic temperature sensor required for proper operation of boiler. Coordinate required installation locations with contractor. Control wiring shall be installed in conduit.

B. BAS Interface: Factory installed hardware and software to enable building automation system to monitor and display boiler status and alarm.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual -reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.

2.5 GAS VENTING

A. The boiler manufacture shall provide and size the appropriate UL listed boiler breaching system including all required accessories including but not limited to roof thimble, exit conde, rain/stack cap, etc.. Construction to be AL29-4C inner wall, stainless steel outer wall.

2.6 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color-coded to match wiring diagram.
3. Install factory wiring outside of an enclosure in a metal raceway.
4. Field power interface shall be to fused disconnect switch.
5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
6. Provide each motor with overcurrent protection.

PART 3 EXECUTION

3.1 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, sized minimum of 4 inches larger than boiler base in accordance with Section 03 30 00.

D. Pipe relief valves to nearest floor drain.

E. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

F. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface; see Section 25 15 00.

3.2 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. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

END OF SECTION

SECTION 23 64 23 - SCROLL WATER CHILLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-cooled scroll water chillers.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

C. Section 23 08 00 - Commissioning of HVAC.

D. Section 23 09 93 - Sequence of Operations for HVAC Controls.

E. Section 23 21 13 - Hydronic Piping.

F. Section 23 21 14 - Hydronic Specialties.

G. Section 25 35 19 - Integrated Automation Control Valves.

H. Section 26 05 83 - Wiring Connections.

1.3 REFERENCE STANDARDS

A. AHRI 550/590 (I-P) - Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle; 2023.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

C. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata and Amendments (2022).

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

E. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

D. Manufacturer's Certificate: Certify that components furnished but not produced by manufacturer meet or exceed manufacturer's requirements.

E. Manufacturer's Performance Data: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature for water-cooled chillers and at specified and minimum outdoor air temperature for air-cooled chillers.

F. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written installation instructions for rigging, unloading, and transporting units.

B. Deliver units to the job site completely assembled and charged with refrigerant and oil by manufacturer.

1.6 WARRANTY

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

B. Manufacturer's Warranty: Provide minimum five year warranty to include coverage for materials and labor for compressor and complete assembly.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carrier Corporation: www.carrier.com/#sle.

B. Daikin Applied Americas, Inc: www.daikinapplied.com/#sle.

C. Trane Technologies, PLC: www.trane.com/#sle.

D. York, a brand of Johnson Controls International, PLC: www.york.com/#sle.

E. Substitutions: See Section 01 60 00 - Product Requirements.
1. The chilled water system has been designed based on specific capacities and characteristics of equipment specified in this section and other sections.

2.2 SCROLL-WATER CHILLER PERFORMANCE REQUIREMENTS

2.3 AIR-COOLED, SCROLL WATER CHILLER

A. Refrigerant: R-454B; use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

B. Factory assembled and tested chiller consisting of compressor(s), compressor motor(s), evaporator, condenser, enclosure, refrigeration circuits(s) and specialties, interconnecting piping, starters, and microprocessor-based controls.
   1. Rating: AHRI 550/590 (I-P).
   2. Safety: UL 1995 and ASHRAE Std 15.
   3. Construction and Testing: ASME BPVC-VIII-1 as applicable for construction type.
   4. Enclosures:
      a. Frame: Heavy-gauge steel with hot-dipped galvanized or air-dried paint finish.
      b. Steel Cabinets: Factory apply baked on enamel or baked on powder paint finish.
      c. Perform 500-hour minimum salt spray test in accordance with ASTM B117.

C. Hermetic Scroll Compressor:
   1. Unit: Fully hermetic type with multiple, direct drive compressors with discharge and suction service valves.
   2. Vibration Control: Factory installed internal isolators or field installed external isolators.
   3. Oil Lubrication System: Initial oil charge, oil sump, heater, oil level, and sight glass.
   4. Capacity Reduction System: Compressor staging with control down to 12 percent of full load without the activation of hot gas bypass.
   5. Motor: 3600 or 3500 rpm, suction gas-cooled, with thermal or current overload protection.

D. Evaporator:
   1. Shell and tube type.
      a. Shell, removable heads and tube support sheets constructed of carbon steel.
      b. Tubes: Mechanically treated copper tubes fixed and aligned into intermediate tube support sheets across the shell to maintain consistent spacing between tubes.
      c. Working Pressure Rating, Refrigerant Side: 400 psi minimum.
      d. Working Pressure Rating, Water Side: 150 psi minimum.
      e. End Connections: Provide with flanged or grooved connections.
      f. Cold Surfaces Insulation.
         1) Insulation is factory or field installed on shell, connections, and suction piping.
         2) 0.75 inches minimum thick, closed cell, expanded polyvinyl chloride, polyurethane, or vinyl nitrate polymer insulation with a maximum K factor of 0.28.
      g. Provide factory installed vents and water drain connections on evaporator or piping.
      h. Provide factory or field installed fittings for temperature control sensors on evaporator or piping.
      i. Freeze Protection for Outdoor Locations: Provide thermostatically controlled electric heater to protect from freezing at ambient temperatures down to minus 20 degrees F.

E. Air-Cooled Condenser, Finned-Tube Type:
   1. Finned-Tube Type:
      a. Mechanically bond aluminum fins to copper tubing and protect with corrosion resistant materials or coatings.
      b. Clean, dehydrate and test.
      c. Leak Test: 650 psi minimum.
   2. Coil Guards: Provide corrosion proof, louvered panels or grilles, factory installed. Protect condenser coil by enclosing with heavy plastic to prevent damage during shipping or rigging.
   3. Fans and Motors:
      a. Fans: Dynamically balance propeller, shrouded-axial, or airfoil type fans of reinforced polymer or glass fiber reinforced composite corrosion resistant construction equipped with sealed, permanently lubricated ball bearings.
      b. Discharge Fan Guards: Corrosion resistant, heavy gauge, steel wire.

c. Discharge Direction: Vertical.
d. Motors: Direct drive, totally enclosed for outdoor use with current overload protection.

F. Refrigerant Circuits:
1. Provide multiple independent refrigeration circuits with one or multiple compressor(s) per circuit.
2. Provide liquid line shut-off valve, filter-drier, expansion valve, and refrigerant relief device for each independent circuit.

G. Controls Package:
1. Unit Controls: Factory-supplied DDC:
a. Control-panel mounted with required input-output expansions, power supply, fused disconnect, hand switches, knobs, and accessories required to control chiller unit to manufacturer required sequences to meet intended use with listed performance.
b. Factory configured to interface prewired sensors, switches, and safeties with allowance to add up to four chiller valves and flow sensors.
c. Graphic-based touchscreen to include unit operation controls and user filter based interface for faults, alarms, performance, unit diagnostics, and data recording up to 12 months.
d. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.
e. External Point Mapping: Provide mapping table for each parameter included in the local visual interface with software-toggle flag to allow reduced mapping of available points.
f. Isolation Valves: Field-installed, 2-position, butterfly type with position tracking; see Section 25 35 19.

H. Electrical:
1. Compliance: NEMA EN 10250 or UL 1995 as applicable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on vibration isolators.

D. Connect to electrical service.

E. Connect to chilled water piping.

F. Arrange piping for easy dismantling to permit tube cleaning and removal.

3.2 MANUFACTURER'S FIELD SERVICES

A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty.

B. Supply initial charge of refrigerant and oil if not completely factory charged.

C. Demonstrate system operations and verify specified performance.

3.3 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. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

END OF SECTION

SECTION 23 73 13 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Casing construction.

B. Fan section.

C. Coil section.

D. Filter and air cleaner section.

E. Damper section.

F. Total energy recovery wheel section.

G. Ultraviolet lights.

H. Access section.

1.2 RELATED REQUIREMENTS

A. Section 23 34 16 - Centrifugal HVAC Fans.

1.3 REFERENCE STANDARDS

A. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014 (Reaffirmed 2020).

B. ACGIH - Ultraviolet Radiation: TLV(R) Physical Agents 7th Edition Documentation; 2010.

C. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

D. AHRI 1060 (I-P) - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment; 2018.

E. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

F. AMCA 99 - Standards Handbook; 2016.

G. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

H. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

I. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

J. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011 (Reapproved 2021).

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

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 153 - Portable Electric Luminaries; Current Edition, Including All Revisions.

O. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.

Q. UL 1812 - Ducted Heat Recovery Ventilators; Current Edition, Including All Revisions.

R. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

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

B. Product Data:
1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include installation instructions.

E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements for additional provisions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.6 WARRANTY

A. See Section 01 78 00 - 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

2.1 MANUFACTURERS

A. Carrier Global Corporation: www.carrier.com/#sle.

B. Daikin Applied: www.daikinapplied.com/#sle.

C. Trane Technologies, PLC: www.trane.com/#sle.

D. York, a brand of Johnson Controls International, PLC: www.york.com/#sle.

E. Temptrol, Nortek Air Solutions: www.nortekair.com/brand/temtrol/#sle.

2.2 REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.3 CASING CONSTRUCTION

A. Full Perimeter Base Rail:
1. Construct of galvanized steel.
2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:
1. Forming: Form walls, roofs, and floors with at least two breaks at each joint. Provide 2” double wall construction on all walls, doors, roofs and floors. Provide 20 gauge exterior and 20 gauge interior foam filled panels. Provide minimum 16 gauge interior and 20 gauge foam filled exterior galvanized steel floor. Units shall be designed and constructed such that all exterior panels are non-load bearing.
2. Provide mid-span, no through metal, internal thermal break.
3. Construct outer panels of galvanized steel and inner panels of galvanized steel.
4. Casing Air Pressure Performance Requirements:
   a. Able to withstand up to 8 in-wc positive or negative static pressure.
   b. Not to exceed 0.0042 inches per inch deflection at 1.5 times design static pressure up to a maximum of plus 8 in-wc in positive pressure sections and minus 8 in-wc in negative pressure sections.
5. Apply manufacturer's standard coating immediately after cleaning and pretreating, un-coated galvanized steel is not acceptable.
6. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1

C. Casing Insulation and Adhesive:
1. Insulation: ASTM C 1071, Type II, 2” thick 3 pound or 2” foam filled R-12.

2. Location and Application: Encased between outside and inside casing.

D. Access Doors:
1. Construction, thermal and air pressure performance same as casing.
2. Doors shall be provided with neoprene gaskets, applied around entire perimeter of the panel frames.
3. Provide surface mounted handles on hinged, swing doors.
4. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
5. Provide Access Doors in the Following Locations:
   a. Fan section.
   b. Access sections.
   c. Coil sections.
   d. Filter sections.
   e. Mixing sections.

E. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at 8-in wc positive or negative static pressure.

F. Insulation:
1. Foam filled, provide minimum thermal thickness of 12 R throughout.
2. Completely fill panel cavities in each direction to prevent voids and settling.
3. Comply with NFPA 90A.

G. Drain Pan Construction:
1. Provide cooling coil and humidifier sections with an insulated, double wall, stainless steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

H. Finish:
1. Indoor Units:
   a. Provide exterior, galvanized steel panels with manufacturers standard finish.

2.4 FAN SECTION

A. Type: Air foil, single width, single inlet, centrifugal plug fan, in accordance with AMCA 99. See Section 23 34 16

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

E. Mounting:

1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
2. Factory mount motor on slide rails.
3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.
4. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard restrained vibration isolation mounting devices having a minimum static deflection of 2-inches.

F. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.
1. All fan motors shall be factory-wired to individual manual motor protection [MMP] device which shall consist of a motor overload relay with adjustable current rating and an on-off disconnect switch for power isolation. Field wiring of MMP's to fan motors shall not be permitted.
2. MMP's shall be contained in a single control panel [MMP panel] and shall be mounted on the exterior wall panel of the fan array section.
3. MMP panel shall have a single point of connection for input power wiring and shall feed power individual MMP's through a common busbar. Independent wiring of input power to individual MMP's shall not be permitted.

G. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted starter-disconnect, variable frequency drive, and external motor junction box.

H. Fan Accessories:
1. See Section 23 34 16

I. Flexible Duct Connections:
1. For separating fan, coil, and adjacent sections.

J. Drives:
1. Comply with AMCA 99.
2. Bearings: Heavy duty pillow block type, roller bearings with ABMA STD 11 L-10 life at 120,000 hours.
3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.5 COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Drain Pans: 24 inch downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Eliminators: Three break of Type 304 stainless steel, mounted over drain pan.

D. Air Coils:
1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.

E. Fabrication:
1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
2. Fins: Aluminum.

3. Casing:
   a. Chilled Water Coils: Die formed channel frame of stainless steel.
   b. Hot Water Coils: Die formed channel frame of galvanized steel.

F. Water Heating Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

G. Water Cooling Coils:
1. Headers: Cast iron, seamless copper tube, or prime coated steel pipe with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

2.6 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Filter Frame:
1. Filter Rack: Side-access rack designed to hold the metal headers.
2. Filter Slots: Frames shall contain independant slots to house 2 inch and 4 inch filter media.

C. Pleated Media Filters:
1. Media: 2 inch, pleMERV 8, 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.

D. Differential Pressure Gauge:
1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.7 DAMPER SECTION

A. Control Dampers: Low leakage (Class 1A) Control dampers. See Section 23 33 00 - Air Duct Accessories.

B. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor, return, and exhaust air.

C. Internal Face Damper Section: Provide as indicated within the air handling unit.

2.8 TOTAL ENERGY RECOVERY WHEEL SECTION

A. Manufacturers:
1. Airxchange.
2. American Energy Exchange, inc.
3. Loren cook Company.
4. SEMCO Incorporated.
5. Greenheck.

B. Certified in accordance with AHRI 1060 (I-P) and UL 1812 for mechanical, electrical, and fire safety.

C. Wheel Construction: Polymer segmented wheel, (for wheels greater than 26-inch in diameter), strengthened with radial spokes.
1. Enthalpy type for both sensible and latent heat recovery.
2. Must insure laminar flow through at design conditions.
3. Energy transfer ratings must be ARI Certified to Standard 1060 and bear the ARI certification symbol for ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based on ARI 1060.
4. Desiccant shall be silica gel for maximum latent energy transfer, permanently bonded to wheel media, (sprayed on desiccant coatings or desiccant applied after wheel formation are not acceptable).
5. Wheel shall transfer moisture entirely in the vapor phase.
6. Polymer media shall be mounted in a stainless steel rotor.
7. Maximum Solid Size for Media to Pass: 800 micrometer.

D. Motor:
1. Thermally protected.
2. Factory mounted.

E. Maintenance and Access Features:
1. Access doors upstream and downstream of the wheel cassette.
2. Removable wheel segments to facilitate maintenance and cleaning.
3. Adequate space for cleaning, service, and maintenance.

2.9 ULTRAVIOLET LIGHTS

A. Manufacturers:
1. Sanuvox Technologies Inc; Biowall: www.sanuvox.com/#sle.
2. Steril-Aire, Inc; Rapid Install Kit: www.steril-aire.com/#sle.
3. UV Resources; RLM Xtreme: www.uvresources.com/#sle.

B. Tested and recognized by UL 153, UL 1598, and UL 1995 for luminaries, heating, and cooling equipment.

C. UV-C Short Wave Light Array Performance: Provide not less than 190 microwatts/sq in.

D. Materials:
1. Provide UV-C resistant polymeric materials or shield from direct or indirect UV-C light with UV-C tolerant material.
2. UV-C Fixtures: Stainless steel to resist corrosion.

E. Lamp Life: 9000 hours minimum with no more than 20 percent loss of output after two years of continuous use.

F. Control Panel: Provide control panel for each UV-C light array.
1. Comply with UL 508A.
2. Use components marked with minimum SCCR (Short Circuit Current Rating).
3. Provide enclosure with NEMA 4X rating for prevention of corrosion and water ingress.
4. Provide control panel with current sensor to indicate status of UV-C array.

G. Safety Features:
1. Treat view port and other windows to assure UV-C energy emitted is below threshold limit specified by American Conference of Governmental Industrial Hygienists (ACGIH).

2. Provide mechanical interlock switch to disconnect power to UV-C fixtures when opening access door.
3. Provide externally mounted, on-off, disconnect, and shutoff switch with lockout/tagout that disconnects UV-C power and prevents unwanted operation of UV-C lights.

2.10 ACCESS SECTION

A. Provide where indicated on drawings to allow for inspection, cleaning, and maintenance of field-installed components.

B. Construct access doors same as previously specified within this Section.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

D. Provide fixed sheaves required for final air balance.

E. Make connections to coils with unions or flanges.

F. Hydronic Coils:
1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
3. Locate water supply at bottom of supply header and return water connection at top.
4. Provide manual air vents at high points complete with stop valve.
5. Ensure water coils are drainable and provide drain connection at low points.

G. Cooling Coils:
1. Pipe drain and overflow to nearest floor drain.

3.2 SYSTEM STARTUP

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

B. UV-C system to be commissioned by manufacturer field representative.

3.3 CLOSEOUT ACTIVITIES

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

B. 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

SECTION 26 01 00 - ELECTRICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 **SECTION INCLUDES**

A. Electrical General Requirements specifically applicable to Division 26 Sections, in addition to Division 01 - General Requirements.

B. Definitions common to Division 26 specification sections.

1.2 **RELATED REQUIREMENTS**

A. Drawings, addenda and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification Sections, apply to this and all other sections of Division 26.

B. This section is related to all other sections of Division 26.

1.3 **DEFINITIONS**

A. Words "Architect" where written in Division 26 specifications and drawings refer to commissioned Design Professional, whose name appears on contract documents.

B. Word "Engineer" where written in Division 26 specifications and drawings refers to Consulting Electrical Engineer, CMTA, Inc.

C. Word "Contractor" where written in Division 26 specifications and drawings refers to Electrical Contractor and any and all of his subcontractors.

D. Word "Furnish" where written in Division 26 specifications and drawings shall mean Contractor shall deliver to the site item(s) specified, as well as additional specialized materials and/or accessories necessary for the use and operation of item or items specified.

E. Word "Install" where written in Division 26 specifications and drawings shall mean Contractor shall set in position, connect (including sub-assemblies furnished), and adjust for use. Contractor shall furnish miscellaneous specialty items such as fittings, hangers, fastening devices, etc., as obviously necessary for a complete and operating installation.

F. Word "Material" where written in Division 26 specifications and drawings shall mean any and all apparatus, equipment, devices, fixtures, components, products, assemblies, items, parts, things, and any other pieces specified or shown or required.

G. Word "Labor" where written in Division 26 specifications and drawings shall mean any and all physical effort, manpower, time, expertise, tools, equipment and services to carefully assemble, install and affix all material in a proper, complete and acceptable manner.

H. Word “Low Voltage” where written in Division 26 specifications and drawings shall mean 0 to 1,000 Volts (IEEE).

I. Word "Provide" where written in Division 26 specifications and drawings shall mean Contractor shall perform all labor and furnish all materials and equipment necessary to that specified item or system will be complete and operational in every respect.

J. Performance Verification Testing refers to test performed in the field to ensure proper operation and / or installation of service or products.
   1. Unless noted otherwise, Performance Verification Testing is not required to be provided by a third party testing firm.
   2. Unless noted otherwise, Performance Verification Testing is not required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent.

K. Acceptance Testing refers to formal testing process required prior to acceptance by the Owner.
   1. Unless noted otherwise Acceptance Testing is required to be provided by a third party testing firm.
   2. Unless noted otherwise, Acceptance Testing is required to be witnessed by the Electrical Engineer, Owner, Architect, and / or (if applicable) Commissioning Agent.

L. As-built drawings are prepared by the contractor. They show, in red ink, on-site changes to the original construction documents.

M. Record drawings are prepared by the Architect or Engineer and reflect on-site changes the contractor noted in the as-built drawings.

N. Quality Assurance includes all the planned and systematic activities implemented that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality. Typically, quality assurance procedures are performed before and while the work is being performed. As such in the Division 26 specifications Quality Assurance procedures are specified in Part 1.

O. Quality Control includes all the planned activities required to verify quality after the work has been performed. This can include testing and inspections along with other procedures. As such in the Division 26 specifications Quality Assurance procedures are specified in Part 3.

1.4 SCOPE OF WORK

A. All Specifications, corresponding Drawings and all Addenda form a complete set of documents for electrical work for this project, and no part shall be considered complete without the other.

B. The Specifications, Drawings, and all Addenda describe both the design characteristics and functional performance criteria that the completed electrical systems shall include.

C. Contractor shall obtain all required licenses, permits, plan reviews, inspections and pay all fees, costs and all other charges for this project. All sales, use and any other taxes shall be paid by Contractor.

D. Electrical Work shall comply with all ordinances, laws, regulations and codes applicable to the work involved. If, in any instance, the plans and specifications conflict with such laws, the stricter requirement shall take preference.
   1. If Contractor is aware of conflicts between drawings or specifications and such codes or regulations, they shall be brought to the Engineer's attention prior to commencing work. If Contractor performs work in violation of such codes or regulations, Contractor shall correct the violation at his expense.

E. Work under Division 26 includes providing all labor and materials necessary for satisfactory completion of all electrical work shown on all drawings and in all specification divisions.

1.5 SITE INVESTIGATION

A. Prior to submitting bids, visit the work site to become familiar with existing conditions which may affect the cost of the project. This includes measurements for lengths, quantities, clearances and all other field verifiable conditions.

B. No extra charges will be allowed because of failure of Contractor to become familiar with all existing conditions.

C. Where work under this project requires extension, relocation, or modifications to existing equipment, systems or installations the existing equipment, system or installations shall be restored to their original condition, with exception to the work under this project, before completion.

D. Existing equipment, systems and installations which are not detailed on the drawings must still be restored to their original condition.

1.6 **DRAWINGS**

A. Drawings indicate the extent and general layout of the electrical systems.

B. The electrical drawings are diagrammatic (that is, designed to demonstrate or explain the scope of work), they are intended to be as accurate as planning can determine.

C. The scales are shown for estimating purposes only. Field verification of dimensions, locations, and construction details is required. Review appropriate drawings (for example: shop drawings), make field measurements and adjust work to suit the conditions encountered. Although electrical drawings are diagrammatic, they shall be followed as closely as actual construction permits.

D. Contractor shall coordinate with civil, architectural, structural, and mechanical construction drawings for locations of partitions, walls, beams, shafts, equipment, etc.

E. In general, the drawings of the Electrical Systems and Equipment are to scale, however, to determine exact locations of walls and partitions, the Contractor shall consult the Architectural and/or Structural Drawings which are dimensioned. Drawings shall not take precedence over field measurements. Plans showing circuiting or conduit routing, although shown on scale drawings, are diagrammatic only. They are intended to indicate the size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail or exact arrangement of construction
   1. **DO NOT SCALE LOCATIONS OF ELECTRICAL OUTLETS, LIGHT FIXTURES, OR OTHER DEVICES FROM ELECTRICAL DRAWINGS**.
   2. Because the drawings are to a relatively small scale to show as large a portion as is practical, the fact that only certain features of the system are indicated does not mean that other similar or different features or details will not be required. The Contractor shall furnish all incidental labor, materials, or equipment for the systems under their control, so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the Specifications.

F. The Contractor shall be responsible for determining all field measurements before commencing construction, giving due consideration to building design and other equipment to be installed. Electrical equipment not dimensioned on the drawings shall be field located, giving due consideration to the work of other trades. The Contractor shall verify all dimensions before proceeding with the work. Where cutting and patching is required, each Subcontractor shall be responsible for their own work, unless otherwise determined by the Contractor.

1. If the Contractor discovers any discrepancy between actual measurements and those shown on the drawings which prevents good practice, good arrangement, or which is contrary to the intent of the drawings and specifications, they shall notify the Engineer before proceeding with the work

G. Standard electrical symbols along with special symbols are used on all drawings.

1.7 COORDINATION

A. If it is found before installation of any or all construction phases, that a more convenient, suitable or workable arrangement of any or all phases of the project would result by varying or altering the arrangement indicated on the drawings, the Engineer may require any or all Contractors to change the location or arrangement of their work without additional cost to the Owner. Such rearrangement shall be in accordance with directions from the Engineer, Architect, Owner, or Consruction Manager.

B. Where discrepancies are discovered after certain portions or phases of any Contract have been installed, the Engineer, Architect, Owner, or Construction Manager may direct the Contractor to make minor changes in conduit, outlet, fixture or equipment locations or arrangements to avoid conflict with other work at no additional cost to the Owner. It shall be the responsibility of the Contractor to provide written notification prior to making any changes or performing any additional work described in the plans and specifications. The Contractor may not be compensated for work done before providing notification.

1.8 **QUALITY ASSURANCE**

A. Notify the Architect or Engineer of any discrepancies in or omissions from the drawings or documents. Neither theh Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.

B. If discrepancies are not reported, the Contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.

C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect / Engineer for clarification.

D. All minor items necessary for the completion and successful operation of the system, whether or not herin definitely specified or indicated on the drawings, shall be furnished and installed.

E. Omission of / or express reference to any material necesssary for / or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.

F. Any work not clear to Contractor shall be referred to Architect or Engineer for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Architect or Engineer, whose decision shall be final, without additional charges.

G. By virtue of submitting a bid, Contractor agrees they are skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees they have carefully reviewed all drawings, all specifications and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

H. Should major changes from drawings and specification be necessary, Contractor shall provide notification and secure written approval and agreement concerning such changes before work is started.

1.9 WARRANTY

A. The Contractor shall be held responsible for any and all defects in equipment and workmanship which appear for one (1) full year after the date of Substantial Completion. All such defects must be repaired or defective equipment promptly replaced by the Contractor at no expense to the Owner..

B. The warranty guarantee shall extend one year minimum from the date of final acceptance of the work or for as long as normal equipment manufacturer warranties are in effect from the date of final acceptance of the work.

C. During the warranty period, the Electrical Contractor shall respond by making appropriate corrections or repairs required to correct defect within one week of notification. Notification shall be made by telephone, email, or letter.

D. The Electrical Contractor shall provide 24-hour service in case of emergency.

1.10 ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement (contract).

B. Coordinate related work and modify surrounding work as required.

C. Schedule of Alternates: See Division 00 and Division 01.

1.11 UNIT PRICES

A. Unit Prices shall include complete compensation for all required labor, products, tools, equipment, incidentals, installation of a piece, portion or item of Work, and overhead and profit.
   1. Include the hourly rate for one journeyman electrician to work at the direction of the Architect or Engineer.

1.12 SUBSTITUTIONS

A. Where substitute materials or prior approved materials are provided, Contractor shall assume all responsibility and pay for all necessary changes resulting from such substitution. This responsibility shall also include any extra costs required by other trades.
   1. Provide Products as specified unless substitutions are submitted in this manner and subsequently accepted.

B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for equipment which meet or exceed the specifications included herein.

C. Required where specifically noted or where materials are specifically identified by a manufacturer's name, model or catalog number. In these cases only such material may be included in base bid. Prior approval of substitute materials shall be required.

D. When a product is considered discontinued by the manufacturer, an equal or better product shall be used instead of the discontinued product, pending engineering approval.

E. Prior approved substitutions:
   1. Requests for prior approval shall be made in accordance with Division 01, as specified below, and indicated in specific specification section.
   2. If Contractor desires to furnish materials other than that named, Contractor or supplier shall apply in writing, to Architect, for prior approval of such material at least ten (10) days prior to bid opening date.
   3. Requests for prior approved substitution shall indicate specific proposed materials in lieu of those specified together with complete technical data for all such proposed material.
   4. All prior approved substitutions will be clearly identified in addenda which will be sent to all bidders well in advance of bid opening. Only material listed on drawings, specifications and addenda shall be provided.

F. Substitutions after execution of contract: Substitution of materials other than those specifically named in contract documents will be approved, by Architect or Engineer, for following reason only:
   1. That material proposed for substitution is equal to or superior, in Engineer and Architect's opinion, to that specified in construction, efficiency, appearance, and utility.
   2. That material named in the documents cannot be delivered to project in time to complete work due to conditions beyond control of Contractor.

G. Equal To and Or Equal: Where materials are specifically identified as “equal to” an identified manufacturer’s name, model, or catalogue numbers or where noted as “or equal” manufacturer’s complying with the requirements of these specifications not listed may be incorporated in the Work. Such materials must be equal to or superior, in Engineer’s opinion, to that specified in construction, efficiency, appearance, and utility.

1.13 DRAWING PLAN BACKGROUNDS AVAILABLE

A. Electronic drawing files may be available to the contractor for the purpose of preparing shop drawings or submittals. Files generally available after signing a waiver.

1.14 RECORD DRAWING

A. The contractor shall maintain one set of drawings at the job site used as a master copy. Each change order or other revision, deletion, or addition shall be clearly marked and noted by colored pencil. This copy of plans shall be furnished to the Architect upon completion of the project.

B. A complete set of these drawings shall be scanned at a resolution of 600dpi in color and saved in an Adobe PDF portfolio format with index to each sheet by name and burned to a non-volatile media. The electronic copy of the as-built drawings shall be transmitted to the Architect. After review and approval by the Architect, the as-built drawings will be turned over to the Owner.

1.15 COOPERATION WITH OTHER TRADES

A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set and/or re-route the conduit where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

B. The Contractor shall furnish to other trades, as required, all necessary electrical characteristics, templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

1.16 PAVEMENT, CURB AND SIDEWALK REPLACEMENT

A. This Contractor shall be responsible for replacement of existing street pavement, curbs, and sidewalks, etc., removed or damaged by them during the course of the work, unless such pavement, curbs, sidewalks are to be constructed under the General Contract. The work shall be done in accordance with local requirements.

1.17 SALVAGE

A. All items removed from existing building shall be salvaged in a workmanlike manner.

B. The handling, storage, and disposition of salvage materials shall be as directed by the Architect. Generally, all salvage material shall remain the property of the Owner. Materials and equipment not wanted by Owner shall be removed from the job site and become the property of the contractor.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 JOBSITE INSPECTIONS

A. Periodic job site observations will be made throughout the construction to review applications for payment, observe methods and materials of construction, and review requirements of the Bid Documents.

B. Contractor shall notify the Engineer, or authority having jurisdiction, and arrange for observation of installation prior to backfill or concealing of systems. Contractor shall, to the maximum practical extent, schedule work to allow for the observation of systems' installation in groups rather than individually.

C. Upon completion of all work, and submittal and approval of Test Reports, Maintenance Manuals and Record Drawings, Contractor shall notify the A/E and shall make arrangements for a Substantial Completion inspection.

D. After the inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement or completion.

E. The Contractor shall promptly comply completely with all the listed requirements. Should the Contractor fail to perform promptly, the Engineer reserves the right to have the work completed by others and the cost deducted from the contract price.

F. The Contractor will be billed for projects which are not complete enough for a Substantial Completion Report (Punch List) by the Engineer when one is previously scheduled.

END OF SECTION

SECTION 26 01 20 - ELECTRICAL SHOP DRAWINGS AND SUBMITTALS

PART 1 GENERAL

1.1 SHOP DRAWINGS AND SUBMITTALS

A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, electronic sets of shop drawings and/or manufacturer's descriptive literature (coordinate exact requirements with architectural specifications) on all equipment required for the fulfillment of the Contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted, or specified by hand shall be noted in color red on the submittals. Make any corrections or changes required and resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from Drawings or Specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

B. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

C. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

D. The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the Project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this Project.

E. No cutting, fitting, rough-in, connections, etc., shall be accomplished until “Reviewed” equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain “Reviewed” shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

F. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:
   1. Power Equipment:
      a. Switchboards and panelboards.
      b. Transformers.
      c. Generators.
      d. Automatic transfer switches.
      e. Circuit breakers or fusible switches, per each type.

f. Power and lighting contactors.
g. Disconnect switches.
h. Fuses, per each type required.
i. Magnetic starters, if not submitted with unit equipment by supplier.
j. Control components (relays, timers, selector switches, pilots, etc.)
k. Building service grounding electrode components.

2. Raceways:
   a. Conduit (each type).
3. Wireways and each type of wireway fitting.
   a. Surface raceways and fittings.
   b. J-hook assembly.
   c. Junction, pull, and device boxes.
4. Devices:
   a. Building wire, cable splices, and terminations.
   b. Each type of wiring device and their coverplates.
   c. Any special items not listed above.
5. Lighting:
   a. Light fixtures, each by type, marked to indicate all required accessories and lamp selection. Also, provide original color selection chart to allow Architect and/or Engineer to indicate color selection.
   b. Lighting standards or poles.
   c. Photocells, time clocks, contactors or other lighting control devices and accessories.
   d. Control systems (lighting).
6. Miscellaneous
   a. Control panel assemblies.
   b. Non-standard junction/pullboxes.

G. Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, comply with the following:
   1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with “Compliance”. Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
      a. “C” for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
      b. “D” for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
      c. “A” for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
      d. “N/A” for Not Applicable: By noting the term “not applicable” or “N/A” in the margin, it shall be understood that the specified item is not applicable to the project.

H. Provide samples of materials or equipment proposed to be furnished, if requested. Samples shall become the property of the Architect/Engineer and will be returned only when accompanied by a written request to do so.

I. None of the items listed shall be purchased, delivered to the site, or installed, until the item is reviewed. No substitution will be permitted after review except where such substitution is considered by the Architect to be in the best interest of the Owner.

J. Approval Stamp: This review is to verify general conformance with the design concept of the project and substantial compliance with the information provided in the contract documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:
   1. “Reviewed” indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation. Shop drawings that are returned "Reviewed" or "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
   2. “Furnished as Corrected” indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at their discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without any increase in Contract Sum or Time. If the corrections are accepted by the contractor, shop drawings that are returned "Furnished as Corrected" shall not be resubmitted back to the engineer and if submitted will not be reviewed.
   3. “Revised and Resubmit” indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at their discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
   4. “Rejected” indicates that the Submittal does not appear to conform to the specifications, a resubmission is required, and fabrication or procurement is not authorized.

K. If the Engineer rejects (Revised and Resubmit or Rejected) the same section two times the engineer shall be compensated for additional reviews. Contractor is responsible for all delays caused by the resubmittal process.

L. Should the contractor fail to comply with any of the requirements of the preceding sub-paragraphs; then the right is reserved by the Architect to select any or all items in the material schedule, with that selection to be final and binding upon the contractor. The materials selected or reviewed, as the case may be, by the Architect, shall be used in the work at no additional cost to the Owner.

1.2 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor submits approval of materials and/or equipment of different physical size, weight, capacity, electrical characteristics, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc.

B. In all cases where substitutions or deviations affect other trades, the Contractor requesting or submitting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. In the event that a substitution or deviation is approved, it is the submitting contractors responsibility to coordinate any changes with the effected subcontractors. Any drawings, specifications, diagram, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense.

1.3 SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.4 EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Upon Substantial Completion of the Project, the Electrical Contractor shall deliver to the Engineer (in addition to the required Shop Drawings) complete, tabbed, electronic copies of emergency, operation and maintenance instructions and parts lists for all equipment provided. These documents shall at least include:
   1. Detailed operating instructions.
   2. Detailed maintenance instructions including preventive maintenance schedules.
   3. Addresses and phone numbers indicating where parts may be purchased.
   4. Reference architectural specifications for additional requirements.

B. Refer to individual Contract Document Specification Sections for additional requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Variable-frequency drive cable.

D. Wiring connectors.

E. Electrical tape.

F. Heat shrink tubing.

G. Wire pulling lubricant.

H. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 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; 2023.

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 D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

L. NFPA 79 - Electrical Standard for Industrial Machinery; 2021.

M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

O. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

P. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

Q. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

R. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

T. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

U. UL 2277 - Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 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. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

H. Conductor Material:
1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
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.

I. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. 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.
a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
a. 480Y/277 V, 3 Phase, 4 Wire System:
1) Phase A: Brown.
2) Phase B: Purple.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.
b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.
c. Equipment Ground, All Systems: Green.

2.2 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com.
b. Encore Wire Corporation: www.encorewire.com.
c. General Cable Technologies Corporation: www.generalcable.com.
d. Southwire Company: www.southwire.com.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
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, except as indicated below.
a. Installed Underground: Type XHHW-2.

2.3 METAL-CLAD CABLE

A. Manufacturers:
1. AFC Cable Systems Inc: www.afcweb.com.
2. Encore Wire Corporation: www.encorewire.com.
3. Southwire Company: www.southwire.com.

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. Provide dedicated neutral conductor for each phase conductor.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

2.4 VARIABLE-FREQUENCY DRIVE CABLE

A. Manufacturers:
1. AmerCable.
2. General Cable Corporation.

B. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

C. Conductor Material: Stranded.
1. Stranded tinned copper: Annealed fine wire flexible high strand count.
2. Three (3) phase conductors, three (3) ground conductors. Each of the three ground conductors shall be the same size as the single ground conductor shown on the Drawings.

D. Insulation Voltage Rating: 1000 V.

E. Insulation:
1. Flame-retardant cross-lined polyolefin.
2. Conductors shall be cabled together. Ground conductors shall be symmetrical. Fillers shall be included as necessary to make the cable round.

F. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.

G. Shielding: Overall tinned copper braid plus aluminum/polyester tape foil, 100% coverage.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.5 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 Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use compression connectors.

C. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. 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.
4. Copper Conductors Size 8 AWG and Larger: Use compression connectors where connectors are required.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. 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.

G. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.6 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.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

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

3.1 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.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
5. 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. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
6. 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.
7. Provide neutral conductors of the same size as the phase conductor(s) for individual branch circuit homeruns.
8. Provide oversized neutral/grounded conductors where indicated and as specified below.
   a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
   b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
9. Provide a neutral conductor at each light switch location controlling line-to-neutral lighting loads.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. 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.
5. Exercise care in handling and installing conductors to avoid damage. Carefully form conductors in equipment pull boxes. Form bends in conductors larger than the minimum radii shown in the cable manufacturer's published data for minimum bends such that bends will not reduce the cable life.

a. The radius of bending of conductors shall be not less than eighteen (18) times the outside diameter of the conductor insulation.

6. Provide suitable installation equipment to prevent abrasion and cutting of conductors by raceways during the pulling of conductors. Use ropes of polyethylene, nylon or other suitable non-metallic material to pull in feeders. Metallic ropes are prohibited.
7. Attach pulling lines to conductors by means of insulated woven basket grips or by pulling eyes attached directly to conductors. Do not use rope hitches or bare steel basket grips.
8. The pulling of all conductors shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.
9. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove all foreign material and to permit the wire itself to be pulled into a clean, dry conduit.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. 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.

H. 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.

I. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

J. Install conductors with a minimum of 6 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 contaminates. Do not use wire brush on plated connector surfaces.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
6. Provide temperature ratings of connectors and splices to match conductor rating.

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.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

P. Insulate ends of spare conductors using vinyl insulating electrical tape.

Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

S. 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.

T. Run feeders in continuous lengths, without joints or splices. Where continuous runs are impractical, obtain Engineer's approval for splice locations and application.

U. Do not use gutters of panelboards as raceways, junction boxes, or pull boxes for conductors not terminating in said panelboard

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

E. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
   1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   2. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

F. Test Reports: Prepare a written report to record the following:
   1. Test procedure used.
   2. Test results that comply with requirements.
   3. Test results that do no comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 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.

F. Ground access wells.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 36 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 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; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

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.

1.4 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.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 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.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

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.
   d. Provide ground access well for each electrode.
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.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

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. Transformers (except autotransformers such as buck-boost transformers).
   b. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to common grounding electrode conductor ground riser. 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. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. 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.
6. 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.
7. 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. Where parallel conductors in separate raceways occur, provide an equipment grounding conductor in each raceway that meets requirements of NFPA 70.
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.

8. Provide bonding for interior metal air ducts. Provide bonding to duct-mounted electrical devices operating at 120V or more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
9. Provide bonding for each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

I. Communications Systems Grounding and Bonding:
1. Provide bonding jumper in raceway from building grounding electrode system to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
   b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

J. Cable Tray Systems: Also comply with Section 26 05 36.

2.2 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 26 05 26:
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.
   a. Exceptions:
      1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
   a. Burndy LLC: www.burndy.com.
   b. Harger Lightning & Grounding: www.harger.com.
   c. nVent ERICO: www.nvent.com.
   d. Thomas & Betts Corporation: www.tnb.com.
5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC: www.burndy.com.
   b. nVent ERICO; Cadweld: www.nvent.com.
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#s.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600V.
2. Size: As indicated. 1/4-inch x 4-inches in cross section for telecommunications ground bars. 1/4-inch x 2-inches in cross section for electrical room ground bars.
3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 5/8 inch diameter by 8 feet length, unless otherwise indicated.

F. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
a. Round Wells: Not less than 8 inches in diameter.
b. Rectangular Wells: Not less than 12 by 12 inches.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

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 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 05 36 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

D. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3 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; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect of 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 cured; see Section 03 30 00.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.6 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Comply with the following. Where requirements differ, comply with most stringent.
a. NFPA 70.
b. Applicable building code.
c. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 5. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Manufacturers:
a. ABB: www.electrification.us.abb.com.
b. Eaton Corporation: www.eaton.com.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com.
d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
e. nVent; Caddy: www.nvent.com.
2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
3. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported. Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.
1. Manufacturers:
a. ABB: www.electrification.us.abb.com.
b. Eaton Corporation: www.eaton.com.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com.
d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
e. nVent; Caddy: www.nvent.com.

D. Metal Channel/Strut Framing Systems:
1. Manufacturers:
a. ABB: www.electrification.us.abb.com.
b. Atkore International Inc; Unistrut: www.unistrut.us.
c. Eaton Corporation: www.eaton.com.
d. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Comply with MFMA-4.
4. 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.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2-inch diameter.
b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
e. Outlet Boxes: 1/4-inch diameter.
f. Luminaires: 1/4-inch diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Dewalt: anchors.dewalt.com.
   b. Hilti, Inc: www.hilti.com.
   c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com.
2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
5. Hollow Masonry: Use toggle bolts.
6. Hollow Stud Walls: Use toggle bolts.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
   b. Comply with MFMA-4.
   c. Channel Material: Use galvanized steel.
   d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.

PART 3 EXECUTION

3.1 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.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

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. 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. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 4 inches in height; see Section 03 30 00.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.

I. Cable Tray Support and Attachment: See Section 26 05 36 for additional requirements.

J. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.

K. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

L. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners in accordance with manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

Q. No conduit, supports, etc. shall be run through access clearances of equipment by other trades. Coordinate with all trades prior to construction.

3.3 FIELD QUALITY CONTROL

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

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Aluminum rigid metal conduit (RMC).

C. PVC-coated galvanized steel rigid metal conduit (RMC).

D. Flexible metal conduit (FMC).

E. Liquidtight flexible metal conduit (LFMC).

F. Galvanized steel electrical metallic tubing (EMT).

G. Aluminum electrical metallic tubing (EMT).

H. Rigid polyvinyl chloride (PVC) conduit.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 84 00 - Firestopping.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.

D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 31 23 16 - Excavation.

G. Section 31 23 23 - Fill: Bedding and backfilling.

1.3 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. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

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

L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

N. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

O. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

P. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

T. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

U. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect of 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 between termination points is complete.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.

D. Project Record Documents: Record actual routing for conduits installed underground and conduits embedded within concrete slabs.

1.6 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
1. Under Slab on Grade: Use 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 rigid PVC conduit.
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to PVC-coated galvanized steel rigid metal conduit (RMC) where emerging from underground.
5. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape or factory-applied corrosion protection coating acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

6. Where galvanized steel electrical metallic tubing (EMT) is installed in direct contact with earth, use corrosion protection tape or factory-applied corrosion protection coating acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer. Where approved, only branch circuits shall be routed within slab. Feeders shall not be routed within slab.
   2. Within Slab Above Ground: Not permitted.
   3. Where rigid polyvinyl (PVC) conduit is provided, transition to PVC-coated galvanized steel rigid metal conduit (RMC) where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or aluminum rigid metal conduit (RMC).

L. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC).

M. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel electrical metallic tubing (EMT) or aluminum electrical metallic tubing (EMT).

N. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit (RMC).
   1. Corrosive locations include, but are not limited to:
      a. Cooling towers.
      b. Marine environments.
      c. Chemical storage areas.

O. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

C. Provide conduit, fittings, supports, and accessories required for complete raceway system.

D. Provide products listed, classified, and labeled as suitable for purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 3/4-inch trade size.
2. Branch Circuit Homeruns: 3/4-inch trade size.
3. Control Circuits: 1/2-inch trade size.
4. Underground, Interior: 1-inch trade size.
5. Underground, Exterior: 1-inch trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com.
2. Nucor Tubular Products: www.nucortubular.com.
3. Rymco USA: www.rymcousa.com.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com.

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. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.4 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.
3. Rymco USA: www.rymcousa.com.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com.

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. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
2. Material: Use aluminum.
3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. ABB; Ocal: www.electrification.us.abb.com.
2. Calbond, a division of Atkore International www.calbond.com.
3. Robroy Industries: www.robroy.com.

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, 0.040 inch.

D. PVC-Coated Boxes and Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.6 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.

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.

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.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.

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.

2.8 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com.
2. Nucor Tubular Products: www.nucortubular.
3. Rymco USA: www.rymcousa.com.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Factory-Painted, Color-Coded Galvanized Steel EMT: Apply according to indicated color code.
1. See Section 26 05 53 for color coding of conduit for fire alarm wiring and building automation wiring.

D. 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.
4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.9 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. American Conduit, a division of Hydro: www.americanconduit.com/#.

B. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

C. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.
2. Material: Use aluminum.
3. Connectors and Couplings: Use compression/gland or set-screw type.
a. Do not use indenter type connectors and couplings.
4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. ABB; Carlon: www.carlon.com.
2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com.
3. Cantex Inc: www.cantexinc.com.
4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com.
5. JM Eagle: www.jmeagle.com/.

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, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with 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 or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

F. Sealing Systems for Concrete Penetrations:
1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

G. 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.

H. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

I. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

J. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for both direct bury and concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

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 PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. 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.
5. Unless otherwise approved, do not route exposed conduits:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of three 90-degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
   a. Heaters.
   b. Hot water piping.
   c. Flues.
14. Group parallel conduits in same area on common rack.

H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. 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.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is permitted only as follows:
   a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
10. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

I. 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. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations or when conduit is stubbed up above accessible ceiling to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

J. 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. Provide suitable sealing system where conduits penetrate exterior wall below grade.
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.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

K. Underground Installation:
1. Provide trenching and backfilling; see Section 31 23 16 and Section 31 23 23 in addition to this Section.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 36 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground detectable warning tape along entire conduit length; see Section 26 05 53.
4. For multiple conduit runs in an underground trench, provide conduit duct bank spacer support rack to evenly space out and support the conduits in an orderly manner in the trench.

L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
2. Install conduits within middle one third of slab thickness.
3. Secure conduits to prevent floating or movement during pouring of concrete.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.

N. 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.

O. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
   c. Where conduits penetrate coolers or freezers.
3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.

P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

Q. Provide grounding and bonding; see Section 26 05 26.

3.3 EXCAVATION FOR TRENCHES FOR ELECTRICAL DUCT BANKS

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide a minimum 3-inch clearance on each side of conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of conduit unless otherwise indicated.

C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of conduit elevations to allow for conduit support rack.
   1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.4 ELECTRICAL TRENCH BACKFILL FOR DIRECT-BURY DUCT BANK

A. Place backfill on subgrades free of mud, frost, snow, or ice but not before completing the following.
   1. Testing and inspecting underground conduits.
   2. Removing trash and debris.

B. Place and compact initial backfill of bed sand or subbase material in 6 inch lifts, free of particles larger than 1 inch in any dimension, from base of trench to 12 inches above top of conduit.
   1. Carefully compact initial backfill under conduits and compact evenly up on both sides and along the full length of conduit to avoid damage or displacement of conduit. Coordinate backfilling with utilities testing.

C. Place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for joints, fittings, and bodies of conduits.

D. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil.

E. Backfill remaining trench void with satisfactory soil to match grade while removing shoring and bracing.

F. Place underground detectable warning tape in trench at 18 inches below top of finished grade.

3.5 ELECTRICAL TRENCH BACKFILL FOR CONCRETE ENCASED DUCT BANK

A. Place backfill on subgrades free of mud, frost, snow, or ice but not before completing the following.
   1. Testing and inspecting underground conduits.
   2. Removing trash and debris.

B. Place concrete encasement around conduit duct bank from base of trench to 3 inches above top of conduit ductbank.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil.

D. Backfill remaining trench void above concrete encasement with satisfactory soil to match grade while removing shoring and bracing.

E. Place underground detectable warning tape in trench at 18 inches below top of finished grade.

3.6 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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.

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.

3.7 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.8 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 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.

D. Underground boxes/enclosures.

1.2 RELATED REQUIREMENTS

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

B. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 33.13 - Conduit for Electrical Systems:
1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices:
1. Wall plates.
2. Floor box service fittings.
3. Additional requirements for locating boxes for wiring devices.

G. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

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

G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2017.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 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 minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 01 30 00 - 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.
1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for pull boxes, floor boxes, and underground boxes/enclosures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 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. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
    b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
13. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
   a. Indoor Clean, Dry Locations: Type 1, painted steel.
   b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
   b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
   c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.

D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron or corrosion resistant painted galvanized steel floor boxes within slab on grade.
3. Use corrosion resistant painted galvanized steel floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

E. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on Drawings or as required to meet conduit size and bend radius.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Applications:
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
   b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Manufacturers:
      1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com.
      2) MacLean Highline: www.macleanhighline.com.
      3) Oldcastle Precast, Inc: www.oldcastleprecast.com.
   b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
2. Locate boxes as required for devices installed under other sections or by others.
   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
   b. Communications Systems Outlets: Comply with Section 27 10 00.
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.
   a. Where boxes are located in the same vertical channel/stud space on opposite sides of the same wall, provide sound insulating putty around boxes as required to eliminate sound transmission from room to room.
8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated:
    a. Concealed above accessible suspended ceilings. Locate no more than 36 inches above ceiling level. Label each box in area of work with a permanent marker.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

H. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 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.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. 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.

K. Floor-Mounted Cabinets: Mount on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 26 05 26.

T. Identify boxes in accordance with Section 26 05 53.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.23 - SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface raceway systems.

B. Wireways.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 33.13 - Conduit for Electrical Systems.

D. Section 26 05 33.16 - Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

E. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.

F. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate rough-in locations of outlet boxes provided under Section 26 05 33.16 and conduit provided under Section 26 05 33.13 as required for installation of raceways provided under this section.
   3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install raceways until final surface finishes and painting are complete.

2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.2 SURFACE RACEWAY SYSTEMS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com.
2. Legrand North America, Inc: www.legrand.us.

B. Surface Metal Raceways: Listed and labeled as complying with UL 5.

C. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

2.3 WIREWAYS

A. Manufacturers:
1. Eaton Corporation: www.eaton.com.
2. nVent: www.nvent.com.
3. Schneider Electric: www.se.com.

B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.

C. Wireway Type, Unless Otherwise Indicated:
1. Indoor Clean, Dry Locations: NEMA EN 10250, Type 1, painted steel with screw-cover.

2. Outdoor Locations: NEMA EN 10250, Type 3R, painted steel with screw-cover; include provision for padlocking.

D. Finish for Painted Steel Wireways: Manufacturer's standard grey unless otherwise indicated.

E. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.

E. Secure and support raceways in accordance with Section 26 05 29 at intervals complying with NFPA 70 and manufacturer's requirements.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 26 05 26.

3.3 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.4 PROTECTION

A. Protect installed raceways from subsequent construction operations.

END OF SECTION

SECTION 26 05 36 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal cable tray systems:
   1. Metal wire mesh/basket cable tray.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 27 10 00 - Structured Cabling.

1.3 REFERENCE STANDARDS

A. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA VE 1 - Metal Cable Tray Systems; 2017.

D. NEMA VE 2 - Cable Tray Installation Guidelines; 2018.

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

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.
   2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.
   3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   4. Notify of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA VE 2, except do not store cable tray outdoors without cover as permitted in NEMA VE 2.

B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.1 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.

E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.2 METAL CABLE TRAY SYSTEMS

A. Manufacturers:
1. Metal Cable Tray System:
   a. Cablofil, a brand of Legrand North America, Inc: www.legrand.us.
   b. Chalfant Manufacturing Company: www.chalfant-obo.com.
   c. Cope, a brand of Atkore International Inc: www.copecabletray.com.
   d. Thomas & Betts Corporation: www.tnb.com.

2. Source Limitations: Furnish cable tray system and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Comply with NEMA VE 1.

C. Finishes:
1. Zinc Electroplated Steel: Comply with ASTM B633.

D. Metal Wire Mesh/Basket Cable Tray:
1. Material: Zinc electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
2. Tray Depth: As indicated on drawings.
3. Span/Load Rating: As indicated on drawings.
4. Mesh Spacing: 2 by 4 inches.
5. Tray Width: As indicated on drawings.

2.3 SOURCE QUALITY CONTROL

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

B. Metal Cable Tray: Perform factory design tests in accordance with NEMA VE 1, including electrical continuity and load testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify that field measurements are as indicated.

C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.

F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
1. Inside Radius of Fittings: 12 inches.

G. Cable Tray Movement Provisions:
   1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:
      a. Where cable tray crosses structural joints intended for expansion.
      b. Long straight cable tray runs in accordance with NEMA VE 2.
   2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
   3. Set gaps for expansion fittings in accordance with NEMA VE 2.

H. Cable Provisions:
   1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
   2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
   3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.

I. Provide end closures at unconnected ends of cable tray runs.

J. Cable Tray Support:
   1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by cable tray manufacturer.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

K. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 05 26:
   1. Comply with grounding and bonding requirements of NEMA VE 2.
   2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
   3. Provide suitable equipment grounding conductor in each cable tray. Do not use metal cable tray system as sole equipment grounding conductor.
      a. Equipment Grounding Conductor for Steel Cable Tray: Use bare or insulated copper conductor.
      b. Minimum Equipment Grounding Conductor Size: 6 AWG copper.
      c. Bond equipment grounding conductor to each cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.

L. Cable Installation:
   1. Comply with cable installation requirements of NEMA VE 2.
   2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
   3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.
      a. Distance Between Fastening Points for Vertical Runs: 18 inches.
      b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within the cable fill area.

M. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 84 00.

N. Identification Requirements, in Addition to Those Specified in Section 26 05 53.
   1. Use warning labels to identify cable tray with the word message "WARNING! Do Not Use As A Walkway, Ladder, Or Support For Personnel. Use Only As A Mechanical Support For Cables, Tubing and Raceways." at maximum intervals of 20 feet.

3.3 FIELD QUALITY CONTROL

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

B. Inspect cable tray system for damage and defects.

C. Correct deficiencies and replace damaged or defective cable tray system components.

3.4 ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Remove dirt and debris from cable tray.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6 PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting.

B. Section 09 91 23 - Interior Painting.

C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 26 05 36 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

E. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.

F. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

G. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.3 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.

1.4 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.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 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.
   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.
      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. Transformers:
      1) Identify kVA rating.
      2) Identify voltage and phase for primary and secondary.
      3) Identify power source and circuit number. Include location when not within sight of equipment.
   d. 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.
   e. Time Switches:
      1) Identify load(s) served and associated circuits controlled. Include location.
   f. 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 load(s) served. Include location when not within sight of equipment.

4) 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. Emergency System Equipment:
   a. Use identification nameplate to identify emergency system equipment in accordance with NFPA 70.
   b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
4. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
5. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
7. Use field-painted floor markings or floor marking tape to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
   a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
8. 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.
9. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
10. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
   3. Use 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.
   4. 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. Within boxes when more than one circuit is present.
      b. Within equipment enclosures when conductors and cables enter or leave the enclosure.

C. Identification for Raceways:
   1. Use factory-painted conduits to identify specified systems for accessible conduits.
      a. Color Code:
         1) Fire Alarm System: Red.
         2) Building Automation System: Yellow.

2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
3. Use underground warning tape to identify underground raceways.

D. Identification for Boxes:
1. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09 91 23 and 09 91 13 per the same color code used for raceways.
   b. For exposed boxes in public areas, do not color code.
2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   a. For exposed boxes in public areas, use only identification labels.

E. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
2. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles. For devices located within 6-foot of sink or water source, use engraved wallplate.
   a. For receptacles ans in public areas, provide identification on inside surface of wallplate.

2.2 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.
   a. Use only for indoor locations.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:
   a. Equipment Designation: 1/2 inch.
   b. Other Information: 1/4 inch.
   c. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on blue background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.3 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, or plastic 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.

2.4 VOLTAGE MARKERS

A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

B. Minimum Size:

1. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
2. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

C. Legend:
1. Markers for System Identification:
   a. Emergency Power System: Text "EMERGENCY".
   b. Other Systems: Type of service.

D. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. 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

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 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. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. 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. Install underground warning tape above buried lines with a minimum of one tape per trench at 18 inch(es) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

1.3 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.4 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.

1.5 SUBMITTALS

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

B. Study reports, stamped or sealed and signed by study preparer.

C. Site-specific arc flash hazard warning labels.

D. Field quality control reports.

E. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

F. Project Record Documents: Revise studies as required to reflect as-built conditions.
1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6 POWER SYSTEM STUDIES

A. Scope of Studies:
1. Perform analysis of new electrical distribution system as indicated on drawings.
2. 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).
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
a. Known Operating Modes:
1) Utility as source.
2) Generator as source.

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.
   2) Utility Company: See Section 26 21 00 for Utility Company contact information.
b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 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. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
   a. Maximum utility fault currents.
   b. Maximum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination for Life Safety loads and selective coordination for fault durations extending beyond 0.1 seconds for Optional Standby loads.

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
   a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
   b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.

3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    a. Maximum and minimum utility fault currents.
    b. Maximum and minimum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. 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.
2. Short-Circuit Study:
    a. For each scenario, identify at each bus location:
        1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
        2) Fault point X/R ratio.
        3) Associated equipment short circuit current ratings.
    b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
    a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
    b. For each graph include (where applicable):
        1) Partial single-line diagram identifying the portion of the system illustrated.
        2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
        3) Conductors: Damage curves.
        4) Transformers: Inrush points and damage curves.
        5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
        6) Motors: Full load current, starting curves, and damage curves.
        7) Capacitors: Full load current and damage curves.
    c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
        1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
        2) Include ground fault pickup and delay.
        3) Include fuse ratings.
        4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
    d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
    a. For the worst case for each scenario, identify at each bus location:
        1) Calculated incident energy and associated working distance.
        2) Calculated arc flash boundary.

3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.7 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 preparation of studies of similar type and complexity using specified computer software.
1. Study preparer may be employed by manufacturer of electrical distribution equipment.
2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
1. Products:
a. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Comply with Section 26 05 53.
2. Minimum Size: 4 by 6 inches.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
a. Include orange header that reads "WARNING" unless otherwise indicated.
b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
c. Include the following information:
1) Arc flash boundary.
2) Available incident energy and corresponding working distance.
3) Nominal system voltage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.2 FIELD QUALITY CONTROL

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

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

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

END OF SECTION

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. ASHRAE Guideline 1 – 1996.

B. ASHRAE Guideline 0 – 2005.

C. ACG Commissioning Guideline – 2005.

1.2 SUMMARY

A. Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

B. Related Sections:
1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION OF WORK

A. The purpose of the commissioning process is to provide the Owner of the facility with a high level of assurance that the mechanical systems have been installed in the prescribed manner, and operate within the performance guidelines set in the Basis of Design Documents (BOD). The CA shall provide the owner with an unbiased, objective view of the system's installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers and equipment suppliers.

B. The independent commissioning agent (CA) contracted directly with the owner for this project. This specification has been included for reference only to define contractors' responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

1.4 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.5 INFORMATIONAL SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

1.6 ALLOWANCES

A. Labor, instrumentation, tools, and equipment costs for technicians for the performance of commissioning testing are covered by the "Schedule of Allowances" Article in Division 01 Section "Allowances."

1.7 UNIT PRICES

A. Commissioning testing allowance may be adjusted up or down by the "List of Unit Prices" Article in Division 01 Section "Unit Prices" when actual man-hours are computed at the end of commissioning testing.

1.8 CONTRACTOR'S RESPONSIBILITIES

A. Electrical commissioning is primarily the responsibility of the Division 26 subcontractor, but is led under the direction, guidance, and approval of the CxA. Division 26 subcontractor shall take the lead responsibility for the following:
   1. Inspecting, completing, and documenting the Pre-Functional Testing for the electrical systems to ensure the systems are fully operational and ready for Functional Testing.
   2. Demonstrating the operations of the electrical systems for Functional Testing.

B. Participate in commissioning of HVAC&R systems and HVAC&R Instrumentation and Controls Systems as requested by CxA.

C. Provide information requested by the CxA for final commissioning documentation.

D. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.9 CXA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing and adjusting of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.10 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:
   1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
   2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
   3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
   4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
   5. Test and inspection reports and certificates.

6. Corrective action documents.

1.11 SCHEDULING

A. Commissioning shall comply with the Construction Contract schedule. Cooperate with the CxA in the following manner:
   1. Allow sufficient time before final completion dates so that test and balance and commissioning testing can be accomplished.
   2. Provide labor and material to make corrections when required without undue delay.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all necessary test equipment to confirm proper operation of the Electrical Systems.

B. All testing equipment shall be properly calibrated and documentation of such calibration shall be submitted prior to any verification testing.

PART 3 EXECUTION

3.1 TESTING PREPARATION

A. The CxA shall provide the Pre-Functional checklists and Functional Testing forms.

B. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA. These technicians shall be made available to assist the CxA in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the CxA and coordinated by the subcontractor. The subcontractor shall ensure the qualified technician(s) are available and present during the agreed upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.

B. The Division 26 subcontractor shall take the lead in commissioning of the following Electrical Systems:
   1. Lighting Control System.
   2. Emergency Generator.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. System problems and discrepancies may require additional technician time, CxA time, redesign and/or reconstruction of systems, and system components. The additional technician time shall be made available for the subsequent commissioning periods until the required system performance is obtained.

J. Complete Start-Up, Pre-Functional Testing, and Functional Testing documentation for the Electrical Systems. Submit completed test forms to the CxA.

3.3 PRE-FUNCTIONAL CHECKLISTS

A. After the initial equipment submittal phase, the CxA shall prepare Pre-Functional Test forms for each item of equipment as part of the commissioning. Review respective Pre-Functional Test forms for accuracy and completeness and provide comments to the General Contractor and CxA.

3.4 FUNCTIONAL TEST FORMS

A. After the finalization of the Pre-Functional Test forms, the CxA shall prepare Functional Test forms for each system to be documented as part of the commissioning. Review respective Functional Test forms for accuracy and completeness and provide comments to the General Contractor and CxA.

END OF SECTION

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Daylighting controls.

C. Lighting contactors.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 05 73 - Power System Studies.

D. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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.

1.4 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. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

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

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 WARRANTY

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

B. Provide ten year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.1 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.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
1. See Lighting Controls Schedule on Drawings.
2. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

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.
b. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing 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. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. 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.
9. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

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. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.

c. 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. Finish: White.

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
3. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.

E. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
b. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
a. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.

F. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

2.3 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
a. Indoor Photo Sensors: 5 to 100 footcandles.
3. Finish: White unless otherwise indicated.

4. Where wired sensors are indicated, wireless sensors are not acceptable without prior approval of Architect.

C. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

D. Power Packs for Low Voltage Daylighting Control Modules:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Ratings: As required to control the load indicated on drawings.

E. Accessories:
1. Where indicated, provide compatible accessory wall switches for manual override control.

2.4 LIGHTING CONTACTORS

A. Manufacturers:
1. ABB: www.electrification.us.abb.com.
2. Eaton Corporation: www.eaton.com.
3. Schneider Electric: www.se.com.
4. Siemens Industry, Inc; _____: www.new.siemens.com.

B. 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.

C. Short Circuit Current Rating:
1. Provide contactors 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 26 05 73.

D. Enclosures:
1. Comply with NEMA ICS 6.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.

PART 3 EXECUTION

3.1 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 openings for outlet boxes are neatly cut and will be completely covered by devices or 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 lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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.

3.3 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 26 05 33.16 as required for installation of lighting control devices provided under this section.
   1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   2. Locate wall switch occupancy sensors 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.

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 26 27 26.

G. Provide required supports in accordance with Section 26 05 29.

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. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J. Daylighting Control Photo Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
   2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
   3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

K. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

L. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

M. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4 FIELD QUALITY CONTROL

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

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

F. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 COMMISSIONING

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

3.8 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. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. 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.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION

SECTION 26 21 00 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical service requirements.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 31 23 16 - Excavation.

F. Section 31 23 23 - Fill: Bedding and backfilling.

1.3 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.4 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

1.5 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 Owner.

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.

1.6 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

2.1 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: CenterPoint Energy.
1. Point of Contact: Osesiye Ayeni.
2. Email: osesiye.ayeni@centerpointenergy.com.

D. Division of Responsibility:
1. Pad-Mounted Utility Transformers:
a. Transformer Pads: Furnished and installed by Contractor per Utility Company requirements.
b. Transformers: Furnished and installed by Utility Company.
c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
e. Primary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and installed by Utility Company.
f. Secondary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and installed by Contractor (Service Point at transformer).
2. Terminations at Service Point: Provided by Utility Company.

3. Metering Provisions:
   a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.2 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 31 23 16 and Section 31 23 23.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 30 00.

F. Provide required protective bollards in accordance with Utility Company requirements.

G. Provide required support and attachment components in accordance with Section 26 05 29.

H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.

I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

3.3 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General purpose transformers.

B. K-factor transformers rated for nonlinear loads.

C. Small power centers.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 33.13 - Conduit for Electrical Systems: Flexible conduit connections.

E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

F. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.4 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 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 placement of supports, anchors, etc. required for mounting.
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.

1.5 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
1. K-factor Rated Transformers: Include K-factor ratings.

D. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

F. Field Quality Control Test Reports.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
1. Greater than 10 kVA: 104 degrees F maximum.
2. Less than 10 kVA: 77 degrees F maximum.

1.9 WARRANTY

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB: www.electrification.us.abb.com.
2. Acme Electric; Hubbell.
3. Eaton Corporation: www.eaton.com.
4. Schneider Electric: www.se.com.
5. Siemens Industry, Inc: www.new.siemens.com.

B. Source Limitations: Provide transformers produced by single manufacturer and obtained from single supplier.

2.2 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
1. Altitude: Less than 3,300 feet.
2. Ambient Temperature:
a. Greater than 10 kVA: Not exceeding 104 degrees F.
b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.3 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

C. Coil Conductors: Continuous copper windings with terminations brazed or welded.

D. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20

G. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

H. Transformer Enclosure: Comply with NEMA ST 20.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor clean, dry locations: Type 2.
      b. Outdoor locations: Type 3R.
   2. Construction: Steel.
      a. Less than 15 kVA: Totally enclosed, non-ventilated.
      b. 15 kVA and Larger: Ventilated.
   3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
   4. Provide lifting eyes or brackets.

I. Accessories:
   1. Mounting Brackets: Provide manufacturer's standard brackets.
   2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.4 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 1561, and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.

B. K-factor Rating: K-13, or higher. Refer to rating as indicated.

C. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

D. Coil Conductors: Continuous copper windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.

E. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

F. Neutral Bus: Sized to accommodate twice the rated secondary current.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20

I. Mounting Provisions:
1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
2. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 2.
   b. Outdoor locations: Type 3R.
2. Construction: Steel, ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

K. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.5 SMALL POWER CENTERS

A. Description: Factory assembled unit with integral primary circuit breaker, transformer, and distribution section with secondary main and branch circuit breakers; ratings and panel arrangements as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:
1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous windings.

D. Winding Taps: Two 5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20.

G. Mounting Provisions: Suitable for wall mounting.

H. Unit Enclosure:
1. Environment Type per NEMA EN 10250: Type 3R.
2. Construction: Steel.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.
5. Provide lockable hinged door for compartment housing circuit breakers.

I. Secondary Distribution Panel:
   1. Bus: Copper.
   2. Branch Circuit Breakers: Bolt-on.

2.6 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:
   1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
   2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
   3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 4 inch nominal high concrete pad constructed in accordance with Section 03 30 00.
   4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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 Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

D. Perform infrared scan tests and inspections and prepare report:
1. Initial Infrared Scanning: After Substantial Completion, but no more than 60 days after Final Acceptance, perform an infrared scan of each transformer under load. Remove front panels so joints and connections are accessible to portable scanner.
2. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3.4 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

C. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

3.5 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
1. Includes Utility Company contact information.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

K. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

L. UL 891 - Switchboards; Current Edition, Including All Revisions.

M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 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 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. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
2. See Section 26 21 00 for Utility Company contact information and additional requirements.

1.5 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination for Emergency Systems and Legally Required Standby Systems: All overcurrent protective devices proposed for inclusion in the Work on the Emergency Systems branch (NEC Article 700) and the Legally Required Standby System branch (NEC Article 701) shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and emergency power. See Section 260573 for additional requirements.

B. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and standby power to 0.10 seconds. See Section 260573 for additional requirements.

1.6 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Switchboard product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.

E. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.

F. Field Quality Control Test Reports.

G. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.9 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Switchboards: Subject to compliance with requirements, provide products by one of the following:

1. ABB: www.electrification.us.abb.com.
2. Eaton Corporation: www.eaton.com.
3. Schneider Electric: www.se.com.
4. Siemens Industry, Inc: www.new.siemens.com/#sl.

B. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 SWITCHBOARDS

A. Provide switchboards 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: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:
1. Main _____ Device(s): Individually-mounted.
2. Feeder Devices: Panel/group-mounted.
3. Arrangement: Front accessible only (not rear accessible), rear aligned.
4. Gutter Access: Bolted covers.

E. Service Entrance Switchboards:
1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.

F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
   a. Altitude: Less than 6,600 feet.
   b. Ambient Temperature:
      1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.

G. Short Circuit Current Rating:
1. Provide switchboards 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 26 05 73.
2. Minimum Rating: 65,000 rms symmetrical amperes.

H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.

2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Phase and Neutral Bus Material: Copper.
5. Ground Bus Material: Copper.

J. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
   a. Lug Material: Copper, suitable for terminating copper conductors only.
   b. Lug Type:
      1) Provide mechanical lugs unless otherwise indicated.

K. Enclosures:
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
2. Finish: Manufacturer's standard unless otherwise indicated.

L. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
3. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.

M. Surge Protective Device: Where indicated on Drawings. IEEE C62.41-compliant, externally mounted, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, short-circuit current rating complying with UL 1449, latest edition, and matching or exceeding the switchboard short-circuit rating, redundant suppression circuits, with individually fused metal-oxide varistors. Refer to Section 26 43 00.

N. Phase Loss Protection: Provide a phase failue relay on main circuit breaker(s) complete with capacitor trip device and shunt trip. Relay shall be able to be bypassed at any time. All devices shall be factory installed.
1. Basis of Design:
   a. Taylor Electronics, Inc. Phase-Guard PND Model
2. Provide the following options and accessories on the phase failure relay:
   a. Adjustable phase unbalance from 5 to 15 percent.
   b. Adjustable time delay from 0.5 to 20 seconds.
   c. Remote display module mounted to the front of the main section of teh switchboard with USB connection for computer.
   d. Relay shall not trip on total power loss.

O. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

P. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

Q. Owner Metering:
1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.
2. Basis of Design: Electro Industries/GaugeTech Shark 100.
3. Measured Parameters:
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 (kW): For each phase, 3-phase total.
e. Reactive power (kVAR): For each phase, 3-phase total.
f. Apparent power (kVA): For each phase, 3-phase total.
g. Power factor.
h. Real energy (kWh). Accumulated values unaffected by power outages up to 72 hours.
i. Current demand. Demand interval programmable from five to 60 minutes.
j. Power demand: Real, reactive, and apparent.
4. Meter Accuracy: Plus/minus 1.0 percent.
5. Features:
a. Communications Capability: Compatible with system indicated Utilize 10/100BaseT Ethernet with Modbus TCP protocol capabilities to interface with building automation controls system. Provide all accessories necessary for proper interface.
b. Adjustable demand interval.

R. 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.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
1. Interrupting Capacity:
a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:
a. 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.
1) Provide electronic trip circuit breakers for feeders serving Emergency Systems or Legally Required Standby Systems.
b. Minimum Interrupting Capacity:
1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
2) 14,000 rms symmetrical amperes at 480 VAC.
c. 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.

1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
2) Provide interchangeable trip units where indicated.

d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
1) Provide the following field-adjustable trip response settings:
(a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
(b) Long time delay.
(c) Short time pickup and delay.
(d) Instantaneous pickup.
(e) Ground fault pickup and delay where ground fault protection is indicated.

e. Provide the following features and accessories where indicated or where required to complete installation:
1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

3. Insulated Case Circuit Breakers:
a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
1) Provide insulated case circuit breakers for Main breakers.

b. Operation:
1) Provide manually operated circuit breakers.
2) Pad-Lock Provision: For preventing circuit breaker closing operation.

c. Construction:
1) Provide fixed-mount circuit breakers.

d. Minimum Interrupting Capacity:
1) 65,000 rms symmetrical amperes at 480 VAC.

e. Trip Units: Solid state, microprocessor-based, true rms sensing.
1) Provide the following field-adjustable trip response settings:
(a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
(b) Short time pickup and delay.
(c) Instantaneous pickup.
(d) Ground fault pickup and delay where ground fault protection is indicated.

f. Provide the following features and accessories where indicated or where required to complete installation:
1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
2) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

2.4 SOURCE QUALITY CONTROL

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

B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
1. Dielectric tests.
2. Mechanical operation tests.
3. Grounding of instrument transformer cases test.

4. Electrical operation and control wiring tests, including polarity and sequence tests.
5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

E. Verify underground conduit rough-in complies with the following:
1. Wiring entries comply with layout requirements.
2. Entires are within conduit-entry tolerances specified by manufacturer and no feeders will have to corss section barriers to reach load lugs.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch nominal high concrete pad constructed in accordance with Section 03 30 00.

H. Provide grounding and bonding in accordance with Section 26 05 26.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.

L. Set field-adjustable ground fault protection pickup and time delay settings as directed.

M. Provide filler plates to cover unused spaces in switchboards.

N. Identify switchboards in accordance with Section 26 05 53.
   1. Label each overcurrent protective device and each meter and control device mounted in compartment doors with an identification label.

O. Remove temporary lifting eyes, channels, brackets, and blocking of moving parts from switchboard units and components once unit is secured in place.

P. Operating Instructions: Provide identification label in accordance with Section 26 05 53 with basic operating instructions for switchboard including control and key interlocking sequences and emergency procedures. Mount on front of switchboard at main breaker section.

3.3 FIELD QUALITY CONTROL

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

B. Provide services of a manufacturer's authorized representative to perform inspection and testing. Include manufacturer's reports with submittals.

C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Perform inspections and tests listed in NETA ATS, Section 7.1.

F. Molded Case and Insulated 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 100 amperes. Tests listed as optional are not required.

G. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

H. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

I. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

J. Test shunt trips to verify proper operation.

K. Correct deficiencies and replace damaged or defective switchboards or associated components.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

M. Perform infrared scan tests and inspections and prepare report:
   1. Initial Infrared Scanning: After Substantial Completion, but no more than 60 days after Final Acceptance, perform an infrared scan of each switchboard under load. Remove front panels so joints and connections are accessible to portable scanner.
   2. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

C. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

3.5 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.6 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. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.7 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

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.

1.4 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.

1.5 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination for Emergency Systems and Legally Required Standby Systems: All overcurrent protective devices proposed for inclusion in the Work on the Emergency Systems branch (NEC Article 700) and the Legally Required Standby System branch (NEC Article 701) shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and emergency power. See Section 260573 for additional requirements.

B. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and standby power to 0.10 seconds. See Section 260573 for additional requirements.

1.6 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Panelboard product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

E. 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.

F. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

G. Field Quality Control Test Reports.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

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 written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB: www.electrification.us.abb.com.
2. Eaton Corporation: www.eaton.com.
3. Schneider Electric: www.se.com.
4. Siemens Industry, Inc: www.new.siemens.com.

B. Source Limitations: Provide panelboards and associated components produced by single manufacturer and obtained from a single supplier.

2.2 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 26 05 73.
2. Listed series ratings are not acceptable.

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 where neutral is indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide 200 percent rated neutral bus and lugs where panelboards are fed from K-rated transformers.
3. 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 EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
c. Kitchen and Foodservice Areas: Type 4X stainless steel.
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.
c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
d. Kitchens and Foodservice Areas: Type 4X stainless steel.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.
5. Panelboard Label: Manufacturer's name and trademark, voltage, phase, and amerage shall be located on the interior of the panelboard door.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

K. 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.

L. Load centers are not acceptable.

M. Provide the following features and accessories where indicated or where required to complete installation:
   1. Feed-through lugs.

2.3 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. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type.
   2. Provide thermal magnetic circuit breakers unless otherwise indicated.
   3. Provide electronic trip circuit breakers where indicated and for feeders serving Emergency Systems or Legally Required Standby Systems.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
      a. Doors shall be secured with vault-type latch with tumbler lock.
      b. For doors taller than 48 inches, provide two latches, keyed alike.
   3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 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. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate 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.
4. Each panelboard enclosure shall be limited to 42 pole spaces unless otherwise indicated. If additional pole space is required, an additional enclosure shall be provided with feed through lugs.

2.5 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.
      2) 14,000 rms symmetrical amperes at 480 VAC.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   c. Faceplate on breaker shall list current rating, UL and IEC certification standards, and AIC rating.
3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.
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.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:
      1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. 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.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.6 SOURCE QUALITY CONTROL

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

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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 26 05 29.

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. Mount floor-mounted power distribution panelboards on properly sized 4 inch nominal high concrete pad constructed in accordance with Section 03 30 00.

J. 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.

K. Provide grounding and bonding in accordance with Section 26 05 26.

L. Install all field-installed branch devices, components, and accessories.

M. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

N. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

O. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

P. Set field-adjustable ground fault protection pickup and time delay settings as directed.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Identify panelboards in accordance with Section 26 05 53.
   1. Circuit Directory: Provide computer-generated, type-written circuit directory mounted inside panelboard door with transparent plastic cover. Circuit directory shall identify specific load type for each circuit with sufficient detail to distinguish it from all other circuits.
      a. Circuit load description shall include room number. Use Owner-approved final room numbers, not room numbers indicated on drawings.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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 800 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. Test shunt trips to verify proper operation.

G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

H. Correct deficiencies and replace damaged or defective panelboards or associated components.

I. Perform infrared scan test and inspections and prepare report:
   1. Initial Infrared Scanning: After Substantial Completion, but no more than 60 days after Final Acceptance, perform an infrared scan of each panelboard under load. Remove front covers so joints and connections are accessible to portable scanner.
   2. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates and covers.

D. Floor box service fittings.

E. Poke-through assemblies.

1.2 RELATED REQUIREMENTS

A. Section 26 05 33.16 - Boxes for Electrical Systems.

B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

C. Section 27 10 00 - Structured Cabling: Voice and data jacks.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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.

1.4 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. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

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

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data:
1. GFCI Receptacles: Include information on status indicators.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 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 tamper resistant receptacles for receptacles installed in areas accessible to children.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

2.2 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: White with stainless steel wall plate.

C. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

D. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".

E. Wiring Devices for Computer or Technology Equipment Circuits: Blue with stainless steel wall plate.
1. In classrooms, the receptacle at the teacher station and the receptacles above and below the marker board for the projector on the teaching wall shall be blue.

F. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.

G. Flush Poke-Through Service Fittings: Gray wiring devices with aluminum cover and aluminum flange.

2.3 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.

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: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.

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: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
   3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
   4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   5. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; 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.
   2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
   3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
   4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
   5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:
   1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
   2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A and C) USB charging devices and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
   3. USB Charging Noncombination Devices: Four-port (two Type A and two Type C); rectangular decorator style.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
   1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.

2.5 WALL PLATES AND COVERS

A. 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.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle 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 Receptacle 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.

2.6 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com.
2. Wiremold, a brand of Legrand North America, Inc: www.legrand.us.

B. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: Rectangular.
b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2. Single Service Flush Communications Outlets:
a. Cover: Rectangular.
b. Configuration: _____.
c. Voice and Data Jacks: As specified in Section 27 10 00.
3. Single Service Flush Furniture Feed:
a. Cover: Rectangular.
b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
a. Cover: Rectangular.
b. Configuration:
1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2) Communications: _____.
3) Voice and Data Jacks: As specified in Section 27 10 00.
5. Dual Service Flush Furniture Feed:
a. Cover: Rectangular.
b. Configuration:
1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
6. Accessories:

a. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.7 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com.
2. Wiremold, a brand of Legrand North America, Inc: www.legrand.us.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2. Single Service Flush Communications Outlets:
a. Configuration: _____.
b. Voice and Data Jacks: As specified in Section 27 10 00.
3. Single Service Flush Furniture Feed:
a. Configuration: One 2 inch by 1-1/4 inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
a. Cover: Hinged door(s).
b. Configuration:
1) Power: One standard convenience duplex receptacle(s).
2) Communications: _____.
3) Voice and Data Jacks: As specified in Section 27 10 00.
5. Dual Service Flush Furniture Feed:
a. Configuration:
1) Power: One 3/4 inch threaded opening(s).
2) Communications: Two 1/2 inch threaded opening(s).
6. Accessories:
a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.1 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 floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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.

3.3 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 26 05 33.16 as required for installation of wiring devices provided under this section.
1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
2. 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.
3. 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.
4. 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 26 05 53.

O. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 28 13 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

1.3 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 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 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.

1.5 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination for Emergency Systems and Legally Required Standby Systems: All overcurrent protective devices proposed for inclusion in the Work on the Emergency Systems branch (NEC Article 700) and the Legally Required Standby System branch (NEC Article 701) shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and emergency power. See Section 260573 for additional requirements.

B. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and standby power to 0.10 seconds. See Section 260573 for additional requirements.

1.6 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Fuse product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
1. Spare Fuse Cabinet: Include dimensions.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Fuses: One set(s) of three for each type and size installed.
3. Spare Fuse Cabinet Keys: Two.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.

B. Littelfuse, Inc: www.littelfuse.com.

C. Mersen: ep-us.mersen.com.

2.2 APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

C. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

D. Primary Protection for Control Transformers: Class CC, time-delay.

2.3 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.

H. Class CC Fuses: Comply with UL 248-4.

I. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

J. Provide the following accessories where indicated or where required to complete installation:
1. Fuseholders: Compatible with indicated fuses.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26 05 53.

END OF SECTION

SECTION 26 28 16.13 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed circuit breakers.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within 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.

1.5 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination for Emergency Systems and Legally Required Standby Systems: All overcurrent protective devices proposed for inclusion in the Work on the Emergency Systems branch (NEC Article 700) and the Legally Required Standby System branch (NEC Article 701) shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and emergency power. See Section 260573 for additional requirements.

B. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and standby power to 0.10 seconds. See Section 260573 for additional requirements.

1.6 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Enclosed circuit breaker product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

E. 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.
1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.

F. Field Quality Control Test Reports.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric: www.se.com.

D. Siemens Industry, Inc: www.new.siemens.com.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

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 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:
1. Provide enclosed circuit breakers 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 26 05 73.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide electronic trip circuit breakers where indicated.

H. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

I. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.
c. Kitchen and Foodservice Areas: Type 4X stainless steel.

2. Provide surface-mounted enclosures unless otherwise indicated.

K. Provide externally operable handle with means for locking in the OFF position.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. 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.

B. Interrupting Capacity:

1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   b. 14,000 rms symmetrical amperes at 480 VAC.
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:

1. Provide mechanical lugs unless otherwise indicated.
2. Lug Material: Copper, suitable for terminating copper conductors only.

D. 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.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1. Provide the following field-adjustable trip response settings:
   a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
   b. Long time delay.
   c. Short time pickup and delay.
   d. Instantaneous pickup.
   e. Ground fault pickup and delay where ground fault protection is indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following features and accessories where indicated or where required to complete installation:

1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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 26 05 29.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers 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 26 05 26.

H. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

I. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

J. Identify enclosed circuit breakers in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

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

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1. 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 shunt trips to verify proper operation.

F. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 28 16.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 26 28 13 - Fuses.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

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 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 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.

1.5 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination for Emergency Systems and Legally Required Standby Systems: All overcurrent protective devices proposed for inclusion in the Work on the Emergency Systems branch (NEC Article 700) and the Legally Required Standby System branch (NEC Article 701) shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and emergency power. See Section 260573 for additional requirements.

B. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and standby power to 0.10 seconds. See Section 260573 for additional requirements.

1.6 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Enclosed switch product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

E. 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.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric: www.se.com.

D. Siemens Industry, Inc: www.new.siemens.com/.

E. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 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 26 05 73.
2. Minimum Ratings:
   a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
   b. 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. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
c. Kitchen and Foodservice Areas: Type 4X stainless steel.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:
1. Comply with NEMA BS 31047.
2. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.
b. Lug Material: Copper, suitable for terminating copper conductors only.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.1 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.

3.2 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 26 05 29.

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 26 05 26.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 29 13 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
   1. Magnetic motor starters.
   2. General purpose contactors.
   3. Manual motor starters.

B. Overcurrent protective devices for motor controllers, including overload relays.

C. Control accessories:
   1. Auxiliary contacts.
   2. Pilot devices.
   3. Control and timing relays.
   4. Control power transformers.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.3 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

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 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; 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.

1.4 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 required by NFPA 70.
2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

D. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com.

B. Eaton Corporation: www.eaton.com.

C. Rockwell Automation, Inc: www.rockwellautomation.com/#s.

D. Schneider Electric: www.se.com.

E. Siemens Industry, Inc: www.new.siemens.com.

F. Source Limitations: Provide enclosed motor controllers and associated components produced by single manufacturer and obtained from single supplier.
1. Motor-starting switches without overload protection may be produced by same manufacturer as wiring devices used for project.

2.2 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 determined by short circuit study performed in accordance with Section 26 05 73.

F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures:
1. Comply with NEMA ICS 6.

2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
3. Finish: Manufacturer's standard unless otherwise indicated.

I. 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.

J. Magnetic Motor Starters: Combination type unless otherwise indicated.
1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
2. Configuration: Full-voltage non-reversing unless otherwise indicated.
3. Minimum Starter Size: NEMA Size 0.
4. Disconnects: Circuit breaker type.
   a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
   b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
   c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
5. Overload Relays: Bimetallic thermal type unless otherwise indicated.
6. Pilot Devices Required:
   a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
   b. Single-Speed, Non-Reversing Starters:
      1) Pushbuttons: START-STOP.
      2) Selector Switches: HAND/OFF/AUTO.
      3) Indicating Lights: Red ON, Green OFF.

K. General Purpose Contactors: Combination type unless otherwise indicated.
1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
2. Configuration: Full-voltage non-reversing unless otherwise indicated.
3. Minimum Contactor Size: NEMA Size 0.
4. Disconnects: Circuit breaker type.
   a. Circuit Breakers: Thermal magnetic unless otherwise indicated or required.
   b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
   c. Provide auxiliary interlock for disconnection of external control power sources where applicable.

L. 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.

2.3 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.
8. Solid-State Overload Relays:
   a. Adjustable full load current.
   b. Phase loss protection.
   c. Phase imbalance protection.
   d. Ambient temperature insensitive.
   e. Thermal memory.
   f. Trip test function.
   g. Provide isolated alarm contact.

B. Circuit Breakers:
1. Interrupting Capacity (not applicable to motor circuit protectors):
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Motor Circuit Protectors:
   a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
   b. Provide field-adjustable magnetic instantaneous trip setting.
   c. Provide the following features and accessories where indicated or where required to complete installation:
      1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
      2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
      3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
3. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.

b. 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.
c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    1) Provide the following field-adjustable trip response settings:
        (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
        (b) Long time delay.
        (c) Short time pickup and delay.
        (d) Instantaneous pickup.
        (e) Ground fault pickup and delay where ground fault protection is indicated.
d. Provide the following features and accessories where indicated or where required to complete installation:
    1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.
    3) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

2.4 CONTROL ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
4. Indicating Lights: Push-to-test type unless otherwise indicated.
5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:
1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices.
2. Include primary and secondary fuses.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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 26 05 29.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 26 05 26.

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.

J. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.

K. Identify enclosed controllers in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

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

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 225 amperes. Tests listed as optional are not required.

E. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 32 13 - ENGINE GENERATORS

PART 1 GENERAL

1.1 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.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 23 11 23 - Facility Natural-Gas Piping.

C. Section 23 51 00 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
   1. Includes installation of exhaust silencer specified in this section.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

E. Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 36 00 - Transfer Switches.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

C. NEMA MG 00001 - Motors and Generators; 2024.

D. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2021.

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

F. NFPA 99 - Health Care Facilities Code; 2021, with Amendment.

G. NFPA 110 - Standard for Emergency and Standby Power Systems; 2022.

H. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

I. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.4 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 26 36 00.
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.

1.5 PERFORMANCE REQUIREMENTS

A. Overcurrent Protective Device Coordination for Emergency Systems and Legally Required Standby Systems: All overcurrent protective devices proposed for inclusion in the Work on the Emergency Systems branch (NEC Article 700) and the Legally Required Standby System branch (NEC Article 701) shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and emergency power. See Section 260573 for additional requirements.

B. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for both normal and standby power to 0.10 seconds. See Section 260573 for additional requirements.

1.6 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Engine generator product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. 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.
1. Include generator set sound level test data.

E. 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.

F. Manufacturer's factory emissions certification.

G. Source quality control test reports.

H. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

I. Manufacturer’s detailed field testing procedures.

J. Field quality control test reports.

K. 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.

L. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

M. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.7 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 1 system.
3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).

B. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
1. Contract maintenance office located within 200 miles of project site.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 WARRANTY

A. See Section 01 78 00 - 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

2.1 MANUFACTURERS

A. Packaged Engine Generator Set: Subject to compliance with requirements, provide products by one of the following:
1. Caterpillar Inc: www.cat.com.
2. Cummins Power Generation Inc: www.cumminspower.com.
3. Kohler Co: www.kohlerpower.com.
4. Taylor Power Systems: www.taylorpowergenerators.com.

B. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.2 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. Where design is based on single generator set, use of multiple, smaller unit(s) operated in parallel to obtain equivalent total system power rating is not permitted.

D. Packaged Engine Generator Set:
1. Type: Gaseous (spark ignition).
2. Power Rating: As indicated on drawings, standby.
3. Voltage: As indicated on drawings.
4. Main Line Circuit Breaker:
a. Type: Electronic trip with long time and short time delay and instantaneous pickup.
b. Trip Rating: As indicated on drawings.

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.
1. Altitude: Sea level up to 1000 feet.
2. Ambient Temperature: Between 5 and 40 degrees C.

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 10 seconds (NFPA 110, Type 10).
4. Maximum Load Step: Supports 50 percent of rated load in one step.
   a. Maximum Voltage Deviation with Load Step: 20 percent.
   b. Maximum Frequency Deviation with Load Step: 5 percent.

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. Do not exceed 85 dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.

2.3 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.

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.

2.4 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 00001; 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 00001, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 00001, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

G. Alternator Heater: Provide strip heater to prevent moisture condensation on alternator windings.

2.5 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 Monitoring System: Provide remote monitoring system for monitoring of generator set.
1. Acceptable manufacturer is Zonar System Model No. V4201-H with GPS kit.
2. The system shall include the remote monitoring device with the following hardware:
a. GPS 5-pin data I/O cable.
3. Include the following fees for installation and activation:
a. Set-up fee.
b. Semi-annual service fee.
c. One-time surcharge fee.
d. GSM activation fee.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.6 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective, wind resistant up to 100 mph.

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.

2.7 SOURCE QUALITY CONTROL

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

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.1 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.

3.2 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 4-inch high concrete pad constructed in accordance with Section 03 30 00. Install generator set with elastomeric isolator pads having a minimum deflection of 1-inch. Secure generator set to anchor bolts installed in concrete base.

F. Provide required support and attachment in accordance with Section 26 05 29.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide natural gas piping in accordance with Section 23 11 23.

I. Provide engine exhaust piping in accordance with Section 23 51 00, 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.

J. Install exhaust silencer in accordance with Section 23 51 00, where not factory installed.

K. Provide grounding and bonding in accordance with Section 26 05 26.

L. Identify system wiring and components in accordance with Section 26 05 53.

M. Connect remote monitoring system to generator control panel inside generator enclosure with supplied 5-pin data I/O cable.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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. Perform acceptance test in accordance with NFPA 110.

I. Inspection and testing to include, at a minimum:
   1. Verify compliance with starting and load acceptance requirements.
   2. Verify voltage and frequency; make required adjustments as necessary.
   3. Verify phase sequence.
   4. Verify control system operation, including safety shutdowns.
   5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
   6. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test).

J. Provide field emissions testing where necessary for certification.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

M. After Substantial Competion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so joints and connections are accessible to portable scanner.
   1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 CLOSEOUT ACTIVITIES

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

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. 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. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.5 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

3.6 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 4 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.

C. Maintain an on-site log 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.

END OF SECTION

SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
   1. Automatic transfer switches.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 14 21 00 - Electric Traction Elevators: For interface with transfer switch.

C. Section 14 24 00 - Hydraulic Elevators: For interface with transfer switch.

D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

E. Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

H. Section 26 32 13 - Engine Generators: For interface with transfer switches.
   1. Includes related demonstration and training requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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.

1.4 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 26 32 13.
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.

1.5 SUBMITTALS

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

B. Provide a Specification Compliance Certification in accordance with Section 260120.

C. Simultaneous Action Submittals: Transfer switch product data submittal shall be made in conjunction with submittal required under Section 260573. The release of electrical equipment submittals is dependent on the receipt of a complete and accurate overcurrent protective device coordination study.

D. 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.

E. 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.
   1. Clearly indicate whether proposed short circuit current ratings are based on testing with specific overcurrent protective devices or time durations; indicate short-time ratings where applicable.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Source quality control test reports.

H. Manufacturer’s detailed field testing procedures.

1.6 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 1 system.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

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 transfer switch components, enclosure, and finish.

1.8 WARRANTY

A. See Section 01 78 00 - 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

2.1 MANUFACTURERS

A. Transfer Switches:
1. ASCO Power Technologies: www.ascopower.com.
2. Siemens; Russelectric.
3. Same as manufacturer of engine generator(s) used for this project.

B. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.2 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. For transfer of highly inductive loads (e.g. large motors and transformers), utilize open transition transfer with in-phase monitor or delayed transition transfer.
3. 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.
4. Provide signal before transfer contacts for transfer switches serving elevators.

D. Construction Type: Only "contactor type" (open contact) transfer switches are acceptable. Do not use "breaker type" (enclosed contact) transfer switches.

E. Automatic Transfer Switch:
1. Transition Configuration: Open-transition (no neutral position), utilizing in-phase monitor.
2. Voltage: As indicated on the drawings.
3. Ampere Rating: As indicated on the drawings.

4. Neutral Configuration: As indicated on the drawings.

F. 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).

G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

H. 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.

I. 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.
   b. Where in-phase transfer is indicated, utilize in-phase monitor to initiate transfer when phase angle difference between sources is near zero to limit in-rush currents.
2. Delayed Transition:
   a. Provide break-before-make transfer with programmable time delay in a neutral position not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
3. Neutral Switching: Use simultaneously switched neutral (break-before-make) method. Overlapping neutral method is not acceptable.
4. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
1. Altitude: 1,000 feet.
2. Ambient Temperature: Between 5 degrees C and 40 degrees C.

K. Enclosures:
1. Environment Type per NEMA EN 10250: 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.

L. 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 26 05 73.
2. Short Time Rating: Where the requirement for selectivity is indicated, provide transfer switches with short time ratings suitable for the maximum short time delay setting of the supply side overcurrent protective device.

M. 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.
d. Primary/normal source available.

4. Other Features:
a. Event log.

5. 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.

N. Interface with Other Work:
1. Interface with engine generators as specified in Section 26 32 13.
2. Interface with elevators as specified in Section 14 21 00 and 14 24 00.
a. Utilize signal before transfer contacts to disconnect elevator(s) served prior to transfer.

2.3 SOURCE QUALITY CONTROL

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

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of transfer switches 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 transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 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 26 05 29.

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 03 30 00.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Identify transfer switches and associated system wiring in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

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

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. 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.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. After Substantial Competion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 CLOSEOUT ACTIVITIES

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

B. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

C. 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.

D. Coordinate with related generator demonstration and training as specified in Section 26 32 13.

3.5 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

3.6 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 4 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.

C. Maintain an on-site log 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.

END OF SECTION

SECTION 26 36 33 - GENERATOR DOCKING STATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes a packaged single-purpose temporary generator docking station to connect a temporary generator to the life safety branch automatic transfer switch in the school.

1.2 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section “Electrical Shop Drawings and Submittals” for products specified under PART 2 - PRODUCTS.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 26 Section “Electrical Shop Drawings and Submittals”.

C. Product Data: For each type of product indicated.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
   2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

D. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

E. Warranty: Special warranty specified in this Section.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. UL 1008 or ETL Listed to UL 1008 Standards.

D. Comply with NEC 700.3(F)

E. UL 508A NEMA 3R Enclosure

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of docking station and associated auxiliary components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two (2) years from date of Substantial Completion.

B. The equipment installed under this contract shall be left in proper working order. Replace, without additional charge, new work or material which develops defects from ordinary use within one year.

C. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished.

PART 2 PRODUCTS

2.1 GENERATOR CAMLOCK DOCKING STATION (65KA)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Power Temp Systems.
   2. Trystar.
   3. ASCO.

2.2 GENERAL REQUIREMENTS

A. A set of Camlocks shall be provided for each of the following:
   1. Portable Generator

B. Protective Caps
   1. All Camlocks shall be protected with spring-loaded weather-proof flip covers that are clear in color to allow for easy viewing of phase color and gender.

C. Enclosures:
   1. Wall, Bottom/Side/Top Cable Entry, NEMA 3R rain-tight, stainless-steel enclosure with rake system for cable entry at the bottom.
   2. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.
   3. NEMA 3R integrity shall be maintained while temporary cabling is connected during use.
   4. Front and side shall be accessible for maintenance.
   5. Top, side, and bottom shall be accessible for permanent cabling.
   6. Finishes:
      a. Paint after fabrication. Powder coated Hammer Gray or Black.

D. Phase, Neutral, and Ground Buses:
   1. Material: Silver-plated copper.
   2. Equipment Ground Bus: Bonded to box.
   3. Isolated Ground Bus: Insulated from box.
   4. Ground Bus: 50% of phase size.
   5. Neutral Bus: Neutral bus rated 100 percent of phase bus.
   6. Round edges on bus.

E. Temporary generator connectors shall be Camlock style mounted on gland plate.
   1. Camlock shall be 16 Series model and color coded according to system voltage requirements.

2. Camlock connections shall be Bus Bar Style, Cabling or Double Set Screw is not acceptable.
3. Camlock connection shall be protected against accidental contact while not in use.

F. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier.

G. Short Circuit and Withstand Rating: Minimum 65 kAIC unless otherwise indicated on Drawings.

H. Voltage & Amperage: 480/277V, 3-phase, refer to Drawings for amperage.

I. Factory Installed Phase Rotation Monitor Device: Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and factory installed.

J. Additional accessories shall be included in submittal drawing as follows:
1. K#: Kirk Key Door Interlock. The door of the enclosure shall be kirk key interlocked with the main breaker on the permanent generator feeding the Life Safety ATS.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Surface, Flush or Base Mounted: Specified with order.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

C. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Generator Docking Station vendor shall be required to send a technical representative to the job site to inspect and review installation to ensure it meets the requirements of the consulting engineer.

B. Prepare inspection report that identifies Generator Docking Station with notations of any remedial action taken to correct any issues.

END OF SECTION

SECTION 26 43 13 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes field-mounted SPD for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:
1. Section 26 2413 Switchboards for field installed SPDs.
2. Section 26 2416 Panelboards for field installed SPDs.

1.2 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. I-nominal: Nominal discharge current.

C. MCOV: Maximum continuous operating voltage.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SVR: Suppressed voltage rating.

H. SPD: Surge Protective Device(s), both singular and plural; also, transient voltage surge suppression.

I. VPR: Voltage protection rating.

1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 26 Section “Electrical Shop Drawings and Submittals” for products specified under PART 2 - PRODUCTS.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 26 Section “Electrical Shop Drawings and Submittals”.

C. Product Data: For each type of product indicated. Include rated capacities, clamp times, physical construction, operating weights, electrical characteristics, furnished specialties, and accessories. Include UL 1449, 3rd Edition Listing documentation verifying:
1. Short Circuit Current Rating (SCCR).
2. Voltage Protection Ratings (VPRs) for all modes.
3. Maximum Continuous Operating Voltage rating (MCOV). The MCOV shall be a tested value per UL 1449 3rd Edition, section 37 .7.3. MCOV values based solely on the components used in the construction of the SPD will not be accepted.
4. I-nominal rating (I-n).
5. Type 1 or Type 2 Device Listing.

6. Manufacturer shall provide written test report showing the SPD can survive a single surge at its raged value without the use of circuit breakers or fuses. Single surge ratings based on the sum of components used in the construction of the SPD will not be acceptable.
7. kA rating per phase.
8. kA rating per mode.

D. Warranty: Special warranty specified in this Section.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Certificates: For SPD devices, from manufacturer.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For SPD devices to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

C. Comply with NEMA LS 1.

D. Comply with UL 1449, 3rd Edition.

E. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Service Conditions: Rate SPD devices for continuous operation under the following conditions unless otherwise indicated:
1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F.
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

1.8 COORDINATION

A. Coordinate location of field-mounted SPD devices to allow adequate clearances for maintenance.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS (TYPE A)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ACT Communications, Inc., "471SEL" Series.
   2. ABB Current Technology "SL3" Series.
   3. Southern Tier Technologies.

B. Surge Protection Devices (SPDs):
   1. Comply with UL 1449, 5th Edition, Type 1.
   2. SPD shall have the following features and accessories:
      a. Integral disconnect switch.
      b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
      c. Indicator light display for protection status.
      d. Form C contact: One normally open and one normaly closed, for remote monitoring of protection status, and advanced monitoring with status, surge counter and history log of events.

C. Comply with UL 1283 with a maximum attenuation of 54dB based on 50 ohm insertion loss test per MIL-STD-220B.
   1. Modular design (with field-replaceable modules).
   2. Internal Device Overcurrent Protection (Fuses): All protection modes (including Neutral to Ground) of each surge suppression device shall be internally fused at the component level with fuse I2T capability allowing the suppressor’s maximum rated transient current to pass through the suppressor without fuse operation. If the rated I2T characteristic of the fusing is exceeded, the fusing shall be capable of opening in less than one millisecond and clear both high and low impedance fault conditions. The fusing shall be capable of interrupting up to 200 kA symmetrical fault current with 600 VAC applied. This overcurrent protection circuit shall be monitored to provide indication of suppression failure. Conductor level fuses or circuit breakers internal or external to the surge suppression units are not acceptable as meeting this requirement.
   3. Each MOV shall be individually fuse protected to avoid cascading faults.
   4. Fabrication using bolted compression lugs for internal wiring.
   5. Integral disconnect switch.
   6. Redundant suppression circuits.
   7. Redundant replaceable modules.
   8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
   9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   10. LED indicator lights for power and protection status.
   11. Audible alarm, with silencing switch, to indicate when protection has failed.
   12. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

13. Six-digit transient-event counter set to totalize transient surges.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode. SPD manufacturer shall provide independent third party testing validating unit is capable of surviving a single surge at the specified rating or up to and not to exceed 200 kA.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 1800 V for 480Y/277 V.
4. Neutral to Ground: 1200V for 480Y/277 V.

F. SCCR: Equal or exceed 200 kA.

G. I-nominal Rating: UL labeled with 20 kA nominal for compliance with UL 96A Lightning Protection Master Label and NFPA 780.

H. Repetitive Surge: SPD shall survive a minimum of 14,000 repetitive category C3 (20kV/10kA) surges with no more than 10 percent deterioration. Calculated repetitive surge values will not be accepted. SPD manufacturer shall provide repetitive surge test report.

I. Temporary Over Voltages: SPD shall be able to prevent common temporary over voltages from damaging the MOVs, increasing longevity and ability of SPD unit to protect the critical load.

2.2 SWITCHBOARD AND PANELBOARD SUPPRESSORS (TYPES B AND C)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ACT Communications, Inc., "455 Surge Stryker" Series.
2. ABB Current Technology "TG3" Series.
3. Southern Tier Technologies.

B. Surge Protection Devices (SPDs):
1. Listed as Type 2 SPD per UL 1449, 4th Edition.
2. Include LED indicator lights for power and protection status.
3. Internal thermal protection.
4. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status.
5. Four-digit transient-event counter set to totalize transient surges.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 150 kA (Type B) and 50 kA (Type C). The peak surge current rating shall not be the arithmetic sum of the ratings of the individual MOVs in a given mode. SPD manufacturer shall provide independent third party testing validating unit is capable of surviving a single surge at the specified rating.

D. Comply with UL 1283 with a maximum attentuation of 34 dB based on 50 ohm insertion loss test per MIL-STD-220B.

E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V or 208Y/120 V, 3-phase, 4-wire circuits shall not exceed the follows:
1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.

2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
3. Neutral to Ground: 1000 V for 480Y/277 V and 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V and 1200 V for 208Y/120 V.

F. SCCR: Equal or exceed 100 kA.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

2.4 CONDUCTORS AND CABLES

A. Power Wiring: SPD shall be equipped with mechanical lugs that can accept up to #2/0 AWG wire. Conductors between SPD and switchboard shall be "High Performance Interconnect" (HPI) cables with ultra low impedance characteristics at 10 kHz and above.

B. Class 2 Control Cable: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with copper conductors not smaller than No. 14 AWG, complying with Seciton 25 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 EXECUTION

3.1 INSTALLATION

A. Install service entrance SPD devices (Type A) at service entrance on load side, with ground lead bonded to service entrance ground.
1. Provide direct tap off load side of main bus in switchboard. Utilize #2/0 AWG wire for connection to switchboard with maximum wire length of three feet. Wiring shall be "High Performance Interconnect" (HPI) cable with ultra low impedance characteristics at 10 kHz and above.

B. Install SPD devices for distribution panelboards (Type B) on load side and maintain point of attachment as short and straight as possible. Adjust circuit breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. If installed lead length must exceed 10-feet, SPD manufacturer shall provide a low impedance cable that improves the insta
1. Provide 60-A circuit breaker as a dedicated disconnecting means for SPD unless otherwise indicated. Utilize #4 AWG wire for connection to switchboard with maximum wire length of three feet.

C. Install SPD devices for panelboards and auxiliary panels (Type C) on load side and maintain point of attachment as short and straight as possible. Adjust circuit breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground. If installed lead length must exceed 10-feet, SPD manufacturer shall provide a low impedance cable that improves the installed performance.
1. Provide 30-A circuit breaker as a dedicated disconnecting means for SPD unless otherwise indicated. Utilize #8 AWG wire for connection to panelboard with maximum wire length of three feet.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
   1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
   2. After installing SPD devices but before electrical circuitry has been energized, test for compliance with requirements. The tests shall include:
      a. Off-line Testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. Compare field test results to factory benchmark test parameters supplied with each individual unit.
      b. On-line Testing: Verify that suppression and filtering paths are operating at 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage and by visual inspection.
      c. Voltage measurements from Line-to-Ground (L-G), Line-to-Neutral (L-N), Line-to-Line (L-L), and Neutral-to-Ground (N-G), taken at the time of the testing procedure.
   3. Complete startup checks according to manufacturer's written instructions.

D. SPD will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.
   1. Record results of field testing and compare to factory benchmark test parameters supplied with each individual surge protective device. Indicate that the integrity of neutral-to-ground bonds were verified through testing and visual inspection, and that grounding bonds were observed to be in place.
   2. Submit to the Owner's representative and to the Architect/Engineer copies of the startup test results and the factory benchmark testing results for confirmation of proper suppression filter system function.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer’s written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Do not energize or connect service entrance equipment or panelboards to their sources until SPD devices are installed and connected.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 09 23 - Lighting Control Devices.

D. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 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/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

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.

1.4 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.

1.5 SUBMITTALS

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

B. Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

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. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Luminaires shall be DLC listed or Energy Star rated.

1.7 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.

1.8 WARRANTY

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

B. The equipment items shall be supporteed by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
   1. All light fixtures/luminaires and controls shall have an unconditional 10-year warranty. Light fixtures, lamps, drivers, finishes, and all components shall be free from defects in materials and workmanship for a period of ten (10) years from date of Owner's acceptance. Replace of light fixtures and cost of labor shall be the responsibility of the Contractor.
   2. Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shlal be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.
   3. Light fixtures and assocaited equipment shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
   4. Furnish the electronic LED driver manufacturer's warranty. The warrenty period shall not be less than ten (10) years from the date of substantial completion of the electronic LED driver. The warranty shall state the malfunctioning LED driver shall be exchanged by the manufacturer and promptly shipped to the Owner. The replacement LED driver shall be identical to, or an improvement upon, the original design of the malfunctioning LED driver.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Manufacturers:
   1. Subject to compliance with requirements, provide one of the products indicated on Light Fixture Schedule. Refer to Light Fixture Schedule for manufacturers and model numbers. Basis of design for each type shall be the first fixture manufacturer and model number listed for each type.
   2. Manufacturer's catalog numbers together with the descriptions on the drawings and these specifications are indicative of required design, appearance, quality and performance. Refer any discrepancies between any of these to the Engineer for resolution prior to bid. In absence of such notice to the Engineer, provide the greater requirement as directed by the Engineer, without additional cost.

2.2 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. Color rendering index (CRI) shall be 80 (minimum).

H. Correlated color temperature (CCT) shall be 4000K or as indicated on light fixture schedule.

I. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.

J. Suspended Luminaires:
1. Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers.
2. Provide with swivel hangers to ensure a plumb installation.
3. Hangers shall be cadmium-plated steel with swivel-ball tapped for the conduit size indicated.
4. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4-feet or longer to limit swinging.
5. Single-unit suspended fixtures shall have twin-stem hangers.
6. Multiple-unit or continuous row fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end.
7. Rods shall be a minimum 0.18-inch diameter.

K. 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 100,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.3 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.
1. Self-Powered Exit Signs:
a. 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.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

C. Accessories:
1. Provide compatible accessory wire guards where indicated.

2.4 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
3. Driver shall comply with UL 1310 Class 2 requirements for dry and damp locations, NFPA 70 unless specified otherwise. Drivers shall be designed for the wattage of the LEDs used in the indicated application. Drivers shall be designed to operate on the voltage system to which they are connected.
4. Power factor shall be 0.95 (minimum).
5. Class A sound rating.
6. Current crest factor of 1.5 or less.
7. Total harmonic distortion (THD) shall be 20 percent (maximum).

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
a. Wall Dimmers: See Section 26 27 26.
b. Daylighting Controls: See Section 26 09 23.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 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 conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. 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 recessed luminaires to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide four galvanized steel safety wire(s), minimum 12 gauge, connected from each corner of each recessed luminaire to building structure.

G. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.

H. Suspended Luminaires:
1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
2. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 6 feet between supports.
3. Install canopies tight to mounting surface.
4. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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.

1. For electronic dimming drivers, test for full range of dimming capability. Observe for visually detectable flicker over full dimming range.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.4 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. 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.

3.5 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.

3.6 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts and drivers.

C. Poles and accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 26 05 33.16 - Boxes for Electrical Systems.

C. Section 26 28 13 - Fuses.

1.3 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; 2023.

D. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

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

F. UL 1598 - Luminaires; Current Edition, Including All Revisions.

G. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 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.

1.5 SUBMITTALS

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

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

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.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Luminaires shall be DLC Listed or Energy Star rated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 WARRANTY

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

B. The equipment items shall be supporteed by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
   1. All light fixtures/luminaires and controls shall have an unconditional 10-year warranty. Light fixtures, lamps, drivers, finishes, and all components shall be free from defects in materials and workmanship for a period of ten (10) years from date of Owner's acceptance. Replace of light fixtures and cost of labor shall be the responsibility of the Contractor.
   2. Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shlal be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

3. Light fixtures and assocaited equipment shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
4. Furnish the electronic LED driver manufacturer's warranty. The warrenty period shall not be less than ten (10) years from the date of substantial completion of the electronic LED driver. The warranty shall state the malfunctioning LED driver shall be exchanged by the manufacturer and promptly shipped to the Owner. The replacement LED driver shall be identical to, or an improvement upon, the original design of the malfunctioning LED driver.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Manufacturers:
1. Subject to compliance with requirements, provide one of the products indicated on Light Fixture Schedule. Refer to Light Fixture Schedule for manufacturers and model numbers. Basis of design for each type shall be the first fixture manufacturer and model number listed for each type.
2. Manufacturer's catalog numbers together with the descriptions on the drawings and these specifications are indicative of required design, appearance, quality and performance. Refer any discrepancies between any of these to the Engineer for resolution prior to bid. In absence of such notice to the Engineer, provide the greater requirement as directed by the Engineer, without additional cost.

2.2 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.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Color rendering index (CRI) shall be 80 (minimum).

I. Correlated color temperature (CCT) shall be 4000K or as indicated on light fixture schedule.

J. 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 100,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

K. Exposed Hardware: Stainless steel.

2.3 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum. Form and support to prevent warping and sagging.

C. Door, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping witout use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

F. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components area acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium Satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
      a. Color: Verify color with Architect.

2.6 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. Material: Aluminum, unless otherwise indicated.
   3. Shape: Round tapered, unless otherwise indicated.
   4. Mounting Height: 30-feet, unless otherwise indicated.
   5. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   6. Unless otherwise indicated, provide with the following features/accessories:
      a. Handhole.
      b. Anchor bolts with leveling nuts or leveling shims.
      c. Anchor base cover.
      d. Provision for pole-mounted weatherproof GFI receptacle where indicated.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

PART 3 EXECUTION

3.1 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 conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 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 26 05 29.
   1. Supports:
      a. Sized and rated for luminaire weight.
      b. Able to maintain luminaire position after cleaning.
      c. Support luminaires without causing deflection of finished surface.
      d. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Coordinate layout and installation of luminaires with other construction.

F. Adjust luminaires that require field adjustment or aiming.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

I. 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.
   3. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
   4. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

3.3 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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.

3.4 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

3.5 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.

END OF SECTION

SECTION 27 00 00 - COMMON COMMUNICATIONS REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements contained in this Section apply to all Sections of this Division.

1.2 SUMMARY

A. This section includes general design requirements, administration topics, and installation for communications systems.

B. Refer to section 27 05 10 - Scope of the Communications Work for a description of project scope.

C. Section Includes:
1. Common terminology and requirements used throughout this Division.
2. Identification and labeling.
3. Firestop systems.
4. Sleeves for raceways and cables.
5. Grout.

1.3 DEFINITIONS

AHJ: Authority(ies) Having Jurisdiction.

Architect: The Architect of Record for the project, if any.

Business Day: Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.

CFCI: Contractor Furnished, Contractor Installed

Contract Documents: All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to, plans, specifications, addenda, instructions to bidders (both General and Sub-Contractors), unit prices, change orders, architect’s supplemental instructions, etc.

Contractor: The General Contractor and/or Construction Manager, and any contractor or subcontractor performing any low-voltage communications work in the project, whether proposing/working independently or subcontracted under the.

Engineer: The Consulting Mechanical-Electrical Engineers either consulting to the Owner, Architect, other Engineers, etc.

Furnish: Deliver to the site in good condition.

Install: Install equipment furnished by others in complete working order.

OFCI: Owner Furnished, Contractor Installed

OFOI: Owner Furnished, Owner Installed

Provide: Furnish and install in complete working order.

1.4 GENERAL

A. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. Each Contractor shall be governed by any alternates, unit prices and addenda or other contract documents insofar as may affect the work or services.

C. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of the complete and operating Communications System(s) indicated and/or specified in the Contract Documents.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Communications Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.

E. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

F. It is not the intent of this section of the specifications (or the remainder of the Contract Documents) to make any specific Contractor, other than the Contractor holding the prime agreement, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the Contractor to the Architect (if applicable), then to the Engineer.

G. This section of the Specifications or the arrangement of the Contract Documents shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

H. It is the intent of this Contract to deliver to the Owner a new and complete project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

I. In general, and to the extent possible, all work shall be accomplished without interruption of facility operations. The Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owner shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

J. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

K. Contractor shall not proceed with changes to scope of work and/or substitutions of specified materials without a signed approval by the Owner. Owner reserves the right to refuse payment for work appurtenant to changes and/or substitutions where such work was performed without signed approval. Refer to Division 01 specifications for detailed change and substitution procedures.

1.5 DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work.

B. The drawings and specifications are intended to supplement each other. No Contractor shall take advantage of conflict between them, or between parts of either. This also includes potential conflicts with regards to equipment and material model numbers, part numbers, etc. and respective description and/or performance. Should this condition exist, the Contractor shall request a clarification not less than 10 days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

C. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. Contractor shall make all necessary and required measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of conduit, j-hooks, devices, etc. where such adjustments are in the interest of concealing work or presenting a better appearance. Unless a formal proposal request is issued, this work shall be performed without additional cost to the Owner.

F. Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Communications equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.

G. Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

H. The Drawings are intended to show the approximate locations of equipment, materials, devices, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to ensure no conflict with other work. In case of conflict between small- and large-scale drawings, the larger scale drawings shall take precedence.

I. Where on the Drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work without additional cost to the Owner, the same as if herein specified or indicated.

K. Where on the Drawings or Addenda the word ‘typical’ is used, it shall mean that the work method or means indicated as typical for a condition shall be repeated in each instance where that condition occurs, whether indicated or not.

1.6 SUBSTITUTION PROCEDURES

A. Comply with provisions of Division 01 Section “Substitution Procedures”.

B. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.

C. If an alternate material is proposed that is equal to or exceeds specified requirements, Contractor shall provide manufacturers’ specifications in writing for Owner approval prior to purchase and installation.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. Substitutions of material by the Contractor shall be in writing complete with written manufacturers’ specifications. The material substituted shall not void, alter or change manufacturers’ structured cabling system warranty.

F. Substitutions will not be considered when they are indicated or implied on submittals without separate written request or when acceptance will require revision to the Contract Documents.

G. The Owner will be the final judge of acceptability, with review by Engineer and the distribution of the acceptance by the Architect.

1. No substitute shall be ordered, installed or utilized without the Architect's prior written verification of acceptance from the Owner.

1.7 REFERENCES

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

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.

C. Design, manufacture, test, and install data distribution systems per manufacturer's requirements and in accordance with NFPA 70, state codes, local codes, requirements of authorities having jurisdiction, and particularly the following specifications or standards:
1. ANSI/TIA-568-C: Commercial Building Telecommunications Wiring Standard.
   a. ANSI/TIA-568-C.0: "Generic Telecommunications Cabling for Customer Premises", and its published addenda.
   b. ANSI/TIA-568-C.1: "Commercial Building Telecommunications Cabling Standard", and its published addenda.
   c. ANSI/TIA-568-C.2: "Balanced Twisted-Pair Telecommunication Cabling and Components Standard", and its published addenda.
   d. ANSI/TIA-568-C.3: "Optical Fiber Cabling Components Standard", and its published addenda.
2. ANSI/TIA-569-B: "Commercial Building Standard for Telecommunications Pathways and Spaces", and its published addenda.
3. ANSI/TIA-606-A: "Administration Standard for Commercial Telecommunications Infrastructure".
4. ANSI/TIA-606-B: "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings", and its published addenda.
5. ANSI-J-STD-607-B: "Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications", and its published addenda.
6. ANSI/TIA-942: "Telecommunications Infrastructure Standard for Data Centers", and its published addenda.
7. BICSI Telecommunications Distribution Methods Manual (TDMM)
8. Local, county, state and federal regulations and codes in effect as of date of installation
9. Equipment of foreign manufacture must meet U.S. codes and standards.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements
1. Contractor shall supply all city, county, and state telecommunication cabling permits required by Authorit(ies) Having Jurisdiction.
2. Contractor shall be state-licensed and/or bonded as required for telecommunications/low voltage cabling systems.

B. Certifications
1. Contractor shall submit an up-to-date and valid certification verifying qualifications of the Contractor and installers to perform the work specified herein at time of bid submission.
2. Contractor shall have a complete working knowledge of communication cabling applications such as, but not limited to data, voice and video network systems.
3. Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
4. Contractor shall submit evidence of compliance with these requirements prior to beginning work on the project.

5. Cabling installers shall be trained and certified by the cable manufacturer for telecommunication cabling installations and maintenance of said materials.
6. Maintain current status with the warranting manufacturer, including all training requirements, for the duration of the cable infrastructure project. Staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the lifetime system warranty requirements. After installation, submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, including test results, and to apply for said warranty on behalf of the customer.

C. Administrative Requirements and Coordination requirements
1. Coordinate work of this section with Owner's telephone system specifications, workstations, equipment suppliers, and installers.
2. Coordinate installation work with other crafts (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc) to resolve procedures and installation placement for cable trays and cable bundle pathways.
   a. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components.
   b. Damage by Contractor to the craft work of others will be remedied at the Contractor's expense in a timely manner.
3. Exchange information and agree on details of equipment arrangements and installation interfaces.
   a. Record agreements reached in meetings and distribute record to other participants, Owner and telecommunication consultant.
4. Adjust arrangement and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment.
   a. Tasks shall be coordinated with Owner or his representative, owner's telecommunication utility provider(s) as applicable, and other trades' installation representatives.
5. When requested by Owner or Owner's representative, furnish extra materials that match specified products and that are factory packaged with protective covering for storage and identified with labels describing contents.

D. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.

E. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. Perform the following:
1. Promptly notify the Engineer in writing of any such difference.
2. Obtain approval from Engineer before proceeding with the Work.
3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.

F. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:

1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.

B. Contractor requirements:
1. Be responsible for prompt material deliveries to meet contracted completion date.
2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
4. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
5. Equipment shall not be damaged in any way and shall comply with manufacturer's operating specifications.
6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants.
   a. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
7. Contractor shall be responsible for all handling and control of equipment. Contractor is liable for any material loss due to delivery and storage problems.

C. Owner/General Contractor shall supply a list of security requirements for Contractor to follow.

1.10 PROJECT/SITE CONDITIONS

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Contractor will remove burrs, dirt, and construction debris.
1. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions.

B. Contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

C. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles.
1. If any liquid or other detriment (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

1.11 COORDINATION

A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items. Also, where the description is general in nature, the exact sizes, duties, space arrangements, and other requirements must be obtained by reference to other portions of Contract Documents.

B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping" and in this Section.

F. Roof-Mounted Equipment: Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.12 MAINTENANCE

A. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty or Extended Warranty periods.

PART 2 PRODUCTS

2.1 IDENTIFICATION (LABELING) SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady
2. Brother
3. Dymo
4. Hellerman-Tyton

2.2 FIRESTOP SYSTEMS

A. Refer to Division 07 Section “Firestopping” for additional requirements.

B. General:
1. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
2. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Manufacturers: Subject to compliance with requirements and with through-penetration firestop systems listed in Volume 2 of the UL Fire Resistance Directory, provide products by Specified Technologies, Inc. (STI) or Engineer approved equal.

D. Materials:
1. Firestop Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
   a. STI SpecSeal Series SSS Sealant.
   b. STI SpecSeal Series LCI Sealant.
2. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
   a. STI SpecSeal Series SSP Putty.

3. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:
   a. STI SpecSeal Series SSB Pillows.
4. Fire-Rated Cable Grommet: Molded, two-piece grommet with an integral fire and smoke sealing foam membrane for sealing individual cable penetrations through framed wall assemblies. Grommet snaps together around cable and locks tightly into the wall. The following products are acceptable:
   a. STI EZ-Firestop Grommets.
5. Fire-Rated Cable Pathways: Device modules comprised of steel pathway with self-adjusting intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
   a. STI EZ-PATH Fire Rated Pathway.

2.3 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves:
   1. Schedule 40, galvanized steel
   2. ASTM A 53/A 53M, Type E, Grade B
   3. Burrs shall be removed and insulating bushing fittings installed on ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout:ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.
   1. ASTM C 1107, factory-packaged, nonmetallic aggregate grout
   2. Noncorrosive, non-staining
   3. Mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 EXECUTION

3.1 EXAMINATION

A. Field Measurements
   1. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings.
   2. Coordinate fabrication schedule with construction progress to avoid delaying the work.

B. Established Dimensions
   1. Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field measurements.
   2. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

3.2 PREPARATION

A. Pre-Installation Inspection:

1. Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
2. Visibly damaged goods are not acceptable and shall be replaced by the Contractor at no additional cost to the Owner.

3.3 IDENTIFICATION AND LABELING

A. Cable labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

B. Flat-surface labels: Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.

C. The following color code applies to cabling for all products specified under divisions 27 and 28, unless noted otherwise in the corresponding section:

		Permanent Link Jacket	Cabling Hardware	TR Patch Cords	Workstation Patch Cords
D27	General Data Outlets	Blue	Blue	Blue	Blue
	Wireless Access Points	Yellow	Yellow	Yellow	Yellow
	BAS & Lighting Controls	Green	Green	Green	Green
	AV - Building Data	Blue	Blue	Blue	Blue
	AV - Specialty	Black/Gray	Gray	Gray	Black
	Intercom/Paging System	White	White	White	N/A
D28	Surveillance Cameras	Orange	Orange	Orange	Orange
	Access Control	Violet	Violet	Violet	Violet
	Intrusion Alarm	Violet	Violet	Violet	Violet
	Emergency Responder Radio Antenna System	Red	Red	Red	Red
	Fire Alarm	Red	Red	Red	Red

3.4 CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATION, ETC.

A. Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, extensions, etc. in connection with his work.

B. Contractor shall file all necessary plans, utility easement requests and drawings, survey information on line locations, load calculations, etc. prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.

C. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall be versed in all Codes, Rules and Regulations pertinent to the work prior to submission of a proposal.

D. Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

E. Where minimum code requirements are exceeded in the Design, the Design shall govern.

F. Ensure that the work is accomplished in accordance with the OSHA Standards and any other applicable government requirements.

G. All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction.

H. Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

3.5 CUTTING AND PATCHING

A. Unless otherwise indicated or specified, each Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

B. Each Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. Contractor shall coordinate with the General Contractor any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.

C. Each Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching as well as reinforcement required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

D. Cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

E. Notify other trades in due time where openings of chases in new concrete or masonry are required. Set all concrete inserts and sleeves for work. Failing to do this, cut openings for work and patch same as required at own expense.

F. Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

G. No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

H. Each Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Engineer.

I. All work improperly done or not done at all as required by the Communications trades in this section will be performed by the General Contractor at the direction of the Contractor whose work is affected. The cost of this work shall be paid for by the Contractor responsible.

3.6 SLEEVES AND PLATES

A. Provide and locate all sleeves and inserts required for work before the floors and walls are built, or be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

B. Galvanized steel sleeves shall be provided for all communications conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction.

C. Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.

D. In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.

E. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:
1. Sleeves shall protrude 2 in. beyond penetrated walls, partitions and ceiling.
2. In areas where conduits are concealed, as in chases, terminate sleeves flush with floor.
3. In all areas where conduits are exposed, terminate sleeves 2 in. above finished floor.

F. Sleeves shall be constructed of 24-gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.

G. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

H. Sleeves passing through exterior wall (none are permitted thru roof) or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed. All roof penetrations shall be made inside mechanical equipment curbs.

I. All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.

3.7 WEATHERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. Furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

3.8 FIRESTOPPING

A. Refer to Division 07 Section “Firestopping” for additional requirements.

B. Preparation:
1. Examination of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Do not proceed until unsatisfactory conditions have been corrected.

C. Through-Penetration Firestop System Installation:
1. Install through-penetration firestop systems in accordance with the conditions of testing and classification as specified in the published design.
2. Comply with manufacturer’s instructions for installation of through-penetration firestop systems products.
3. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.
4. Protect materials from damage on surfaces subjected to traffic.

D. Do not penetrate rated fire walls, ceilings or floors with conduit, cable, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the fire-rating of the assembly. Firestop all openings made in walls, chases, ceilings and floors. Patch all openings around conduit, wireway, etc., with appropriate type material to provide needed fire rating at fire walls, ceilings and floors. Fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

E. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly.

F. Apply putty pads to boxes located in fire-rated wall assemblies in which a horizontal distance of greater than 24 in. between boxes is not maintained.

G. Install and seal penetrations (conduit, sleeves, slots, chases) into or through fire-rated barriers created by or made for or on the behalf of the Contractor to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.

H. Coordinate firestopping procedures and materials with General Contractor.

I. Solutions and shop drawings/submittals for firestop materials and systems shall be presented to the General Contractor for written approval of materials/systems prior to purchase and installation.

J. Following the pathway of others through compliant and non-compliant penetrations does not remove the requirement to maintain code-compliant firestopping.

K. Supply Owner with training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

L. Provide manufacturer recommended material for rated protection for any given barrier.

M. Laminate and permanently affix adjacent to chases the following information:
1. Manufacturer of firestop system
2. Date of installation/repair.
3. Part and model numbers of system and all components
4. Name and phone numbers of local distributor and manufacturer's corporate headquarters

N. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and maintain the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

3.9 TESTING

A. Upon completion of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.
1. Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
2. Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
3. Cable/jack shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
    a. Any removal and reinstallation of any component in the circuit shall require retesting of that circuit.
4. Approved instruments, apparatus, services, and qualified personnel shall be utilized.
5. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
6. Manipulation of tester parameters on a failing test in order to achieve a passing test is unacceptable.
7. If the Contractor is found to have manipulated or falsified any failing test result to show a "PASS" for any reason (without written notice and prior approval of the Owner), the Contractor shall be required to employ a Third-Party Testing Agent selected by the Owner to retest the complete cable plant and shall be required to pay all costs associated with this retesting.

B. These specifications will be strictly enforced.
1. The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing parameters listed elsewhere), and documentation as specified below.
2. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at final walk-through in soft copy and printed test data.

C. Notification of the likelihood of a cable exceeding standardized lengths must be made prior to installation of the cable.
1. Without contractor's prior written notice and written approval by the Owner, testing that shows some or all pairs of cable not meeting specifications, shall be replaced at Contractor's expense (including respective connectors).
2. With the Owner's written approval, the over-length cable(s) shall be excluded from requirements to pass standardized tests and shall be explicitly identified.

D. Testing is still required for non-compliant cabling.
   1. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to- ground.
   2. The test results must be within acceptable tolerances and shall be submitted with the Owner's acceptance document.

E. Contractor will complete all work and documentation according to manufacturer guidelines to ensure manufacturer's warranty remains in effect.
   1. Contractor shall obtain certificates from manufacturer attesting to warranty being in effect and include certificates with other deliverables due at the completion of the project.

F. Owner reserves the right to be present during any or all testing.

3.10 SCAFFOLDING, RIGGING AND HOISTING

A. Furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required in strict accordance with OSHA Guidelines.

3.11 CLEANING

A. Work areas will be kept in a broom clean condition throughout the duration of the installation process.

B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

C. The Contractor will damp clean all surfaces prior to final acceptance by Owner.

D. After completion of all work and before final acceptance of the work, thoroughly clean all equipment and materials and remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of equipment, fixtures and all other associated or adjacent fabrication.

3.12 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted, and Owner is satisfied that all work is in accordance with contract documents, the Owner shall notify Contractor in writing of formal acceptance of the system.

B. Contractor must warrant in writing that 100% of the installation meets the requirements specified herein (Standards Compliance & Test Requirements).

C. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation soft and hard copies as describe herein.

3.13 INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

3.14 HAZARDOUS MATERIALS

A. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

END OF SECTION

SECTION 27 05 03 - COMMUNICATIONS SHOP DRAWINGS AND SUBMITTALS

PART 1 GENERAL

1.1 SHOP DRAWINGS

A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, sets of shop drawings and/or manufacturer's descriptive literature (coordinate exact quantity with architectural specifications) on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced per the specifications and/or schedules, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals.

B. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

C. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

D. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

E. The Engineer's review of shop drawings, schedules, product data or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

F. No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

G. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:
   1. Raceways:
      a. Cable tray and each type of cable tray fitting.
      b. J-hook assembly.
   2. Structured Cabling:
      a. Backbone cabling.

b. Horizontal cabling.
c. Patch cords.
d. Patch panels.
e. Racks and cable management.

3. Devices:
   a. Data/voice/video wallplates, each by type.
   b. Any special items not listed above.
4. Systems: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Also, provide scale building layout drawings that indicate device placement, wiring, etc. Refer to the specific system's specification for additional submittal requirements where required.
   a. Data/Voice Network.
   b. Audio Video Systems and Equipment.
   c. Intercommunications and Program Systems.
5. Miscellaneous
   a. Control panel assemblies.
   b. Non-standard junction/pullboxes.
   c. Floor plan and riser drawings that show the location of all communication devices and systems.
   d. Floor plan and riser drawings that show the location of all low-voltage devices and systems.

H. Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, comply with the following:
1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with “Compliance”. Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
   a. “C” for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
   b. “D” for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
   c. “A” for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
   d. “N/A” for Not Applicable: By noting the term “not applicable” or “N/A” in the margin, it shall be understood that the specified item is not applicable to the project.

1.2 SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, etc. and keys to alarm pull boxes, panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.3 MAINTENANCE AND OPERATION MANUALS

A. Upon Substantial Completion of the project, deliver to the Engineer (in addition to the required Shop Drawings) one complete copy and one digital copy of operation and maintenance instructions and parts lists for all equipment provided. At a minimum, these documents shall include the following:
   1. The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
   2. Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
   3. The maintenance and operating manual should contain the following information:
      a. General Building Information and Description.
      b. Technical Information:
         1) System description.
         2) Operating routines and procedures.
         3) Special procedures.
         4) Basic troubleshooting.
      c. Equipment Data Sheets:
         1) Operating and nameplate data.
         2) Warranty.
         3) Addresses and phone numbers indicating where parts may be purchased.
      d. Maintenance Program Information:
         1) Manufacturer’s installation, operation, and maintenance instructions.
         2) Spare parts information.
         3) Preventative maintenance actions.
         4) Schedule of actions.
         5) Action description.
         6) History.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 27 05 10 - SCOPE OF THE COMMUNICATIONS WORK

PART 1 GENERAL

1.1 SUMMARY

A. Each Communications Contractor's attention is directed to Division 27 Section “Common Communications Requirements” and all other Contract Documents as they apply to his work.

B. The Communications work includes all labor, materials, equipment, devices, and related items required to completely install, test, place in service and deliver to the Owner complete communications systems, including but not limited to:
   1. A complete and tested communications structured data cabling distribution system as described in sections 27 10 00, 27 13 23, and 27 15 13:
      a. Optical Fiber Backbone Cabling
      b. Twisted Pair Copper Horizontal Data/Voice Cabling
   2. Intercommunications and Program (Paging) System: system head end equipment, amplifiers, system backbone cabling, speakers, and horizontal speaker cabling.
   3. Audio-Video Systems and Equipment: projectors and sound reinforcement systems for assembly spaces.
   4. Miscellaneous Communication Systems: elevator VoIP communicators.

C. In support of the systems enumerated, provide the following infrastructure, accessories, appurtenances, services etc as needed to deliver complete systems in accordance with the accompanying plans and all provisions of these specifications. These shall include but not be limited to:
   1. All wiring, cabling, etc.
   2. All wiring devices and device plates.
   3. Mounting hardware for installation of equipment per manufacturer instructions and contract drawings.
   4. Power supplies.
   5. Hangers and Supports for Communication Systems, including j-hook pathways, sleeves, and fireproof penetrations throughout the building; coordinate with Division 26.
   6. Communications Equipment Room Fittings, including:
      a. All racks, wire management, patch panels, etc.
      b. Cable tray/cable runway within Telecommunication Rooms.
      c. Plywood blocking for mounting of panels, etc.
      d. Grounding and bonding infrastructure, per NFPA 70, TIA-607, and the specified requirements. Coordinate with Division 26.
   7. All programming, scheduling and testing.
   8. Coordination with external communication utility provider(s) including:
      a. Owner's Fiber WAN provider,
         to ensure that entrance facilities meet utility company specifications and that work, connections, etc., that they are to provide are accomplished.
   9. Coordination with Division 23 for interface with building instrumentation and control system.
   10. Coordination with Division 26 for power, rough-in, conduit and pathways.
   11. Coordination with Division 28 for cabling and interface with electronic safety and security systems.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:

1. System Installer(s) shall be licensed and shall meet all applicable regulations of the State of Texas, Department(s) of Labor, and all other applicable Authorities Having Jurisdiction in so far as they apply to this type of project and the system they propose to install.
2. Installer(s) shall be normally employed in the installation of the system type(s) they propose to install, with three years of documented experience. Proposers shall provide, upon request, reference list and contact names confirming successful installations.

B. Pre-Construction Meeting:
1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.

C. Acceptance:
1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.3 PRODUCTS AND WORK BY OTHERS

A. The Owner may separately purchase and/or provide certain equipment and miscellaneous items that will be installed during the course of the installation process, such as:
1. Wired data network equipment including routers, switches, and other Layer 2 / Layer 3 networking components.
2. Audio-Video Systems and Equipment for classrooms.
Such items may not be indicated in the documents.

B. Contractor shall cooperate with the Owner and his suppliers when considering:
1. Items listed in article A above.
2. The provision and installation of phone systems, related system equipment/software, and employee station equipment/software.
3. The provision and installation of Uninterruptable Power Source (UPS) devices in communications rooms.
4. The provision and installation of Wireless Access Points (WAPs) devices.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 27 05 29 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.2 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; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

I. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

J. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, and post-installed concrete/masonry anchors.

1.4 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Comply with the following. Where requirements differ, comply with most stringent.
a. TIA-569.
b. NFPA 70.
c. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Steel Components: Use corrosion-resistant materials suitable for 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. Conduit Supports: Straps and clamps suitable for conduit to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Noncontinuous Cable Supports: Suitable for cables to be supported, including but not limited to J-hooks and flexible harnesses/slings.
1. Applications:
a. Do not exceed 5 feet between cable supports.
b. Maximum Number of Cables per Cable Support:
1) Per BICSI guidelines and manufacturer instructions.
2. Cable Supports Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.
3. J-Hooks: Noncontinuous cabling support with removable top retainer clip.
a. Material: Use galvanized steel, factory-painted steel, or stainless steel.
b. Provide support surfaces with smooth, beveled edges and radius not less than minimum allowable bend radius of cables supported.
c. Provide multitiered J-hooks where required to support multiple cabling systems.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

E. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Hollow Stud Walls: Use toggle bolts or screws into metal stud channel.
4. Steel: Use beam clamps or machine bolts.
5. Wood: Use wood screws.
6. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
   b. Comply with MFMA-4.
   c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Product Applications:
   1. Within walls, above non-accessible ceilings, and below slab, provide conduit for routing of cabling.
   2. For cabling routed across exposed structure areas, provide conduit for routing or neatly dress and conceal cabling from view.
   3. Above accessible ceilings, provide j-hooks for support of cabling.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

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 or plywood blocking (where provided) 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. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners in accordance with manufacturer's recommended torque settings.

K. Remove temporary supports.

3.2 FIELD QUALITY CONTROL

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

B. Inspect support and attachment components for damage and defects.

C. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 27 10 00 - STRUCTURED CABLING COMMON REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Common qualifications and requirements for Structured Cabling System Installers.

B. Common testing, reporting, and closeout procedures for Structured Cabling System.

C. Comprehensive manufacturer warranty requriements for Structured Cabling System.

1.2 RELATED REQUIREMENTS

A. Section 27 00 00 - Common Communications Requirements, for common requirements applicable to all communication systems and project cable color-coding standard.

B. Section 27 13 23 - Communications Optical Fiber Backbone Cabling, for testing requirements specific to Optical Fiber Cabling.

C. Section 27 15 13 - Communications Copper Horizontal Cabling, for testing requirements specific to Copper Horizontal Cabling.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.
   1. RCDD: Registered Communications Distribution Designer, a BICSI credential.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
   1. Main Cross-Connect (MC):Central cross-connect for backbone cabling to the ICs and HCs. Frequently co-located with the EF.
   2. Horizontal Cross-Connect (HC): Cross-connect facility providing backbone cabling termination and distribution for Horizontal Cabling.
   3. Intermediate Cross-Connect (IC): Cross-connect facility providing intermediate-level backbone cabling distribution.

C. EMI: Electromagnetic interference.

D. Entry-Facility (EF): The facility where service cabling from telecom access providers or campus OSP distribution terminates, also known as the Demarcation Point or Demarc.

E. Equipment Room (ER): An environmentally controlled centralized space for telecommunications equipment. Frequently co-located with the MC or IC.

F. LAN: Local area network.

G. Telecommunications Enclosure (TE): A self-contained enclosure that provides a secure location for connection between backbone and horizontal infrastructure.

H. Telecommunications Room (TR): A room (or space) that provides an environmentally suitable and secure location for the connection between backbone and horizontal infrastructure.

I. Topology (Network): The physical or logical arrangement of nodes, devices, and connections on a network.

J. WAN: Wide area network.

1.4 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement; 2015a (Reaffirmed 2022).

C. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; IEC 61280-4.1 Edition 3.1, Fiber Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement; 2023d.

D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.

1.5 ACTION SUBMITTALS

A. Compliance, Installer Qualifications, and Product Data:
1. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 27 Section “Communications Shop Drawings and Submittals”.
2. Installer's qualification statement(s), including RCDD and Manufacturer/Distributor documentation (See Quality Assurance for requirements).
3. Data/specification sheets for each type of structured cabling product.

B. Shop Drawings & Test Plan: Prepared by Installer's RCDD.
1. Sample System Labeling Schedules:
2. Sample cabling administration drawings and printouts.
3. Plan and Elevation views, including the following:
   a. Building floor plan(s) showing:
      1) Telecommunication room/space locations.
      2) Telecommunications pathways locations.
   b. Enlarged plans of each ER and TR showing equipment rack layout and rack IDs.
   c. Rack elevations showing physical location and IDs of cross-connects and patch panels.
4. Backbone cabling system schematic, indicating cable types and counts to be provided for each connection.
5. Optical fiber cable testing plan(s).
6. Copper twisted pair cable testing plan(s).

1.6 CLOSEOUT SUBMITTALS

A. Warranty, Service, and Test Documentation:
1. Executed warranty document.
2. Warranty service contact information.
3. Test Reports from Installer's field testing indicating and interpreting test results relative to compliance with performance requirements of the installed system(s).
   a. Test data within each section shall be presented in the sequence listed in the administration records.
   b. The test equipment name, manufacturer, model number, and last calibration date shall also be provided in the document.

c. The test document shall detail the test method used and the specific settings of the equipment during the test.
d. When repairs and re-tests are performed, the problem and corrective action taken shall be noted, and both the failed and passed test data shall be submitted.

B. Operation and Maintenance Data:
1. Maintenance data for optical fiber cable, splices, and connectors.
2. Cabling Administration Records as specified in each section.

1.7 QUALITY ASSURANCE

A. Designer Qualifications: Shop Drawings shall be prepared under direct supervision of a BICSI RCDD experienced in design of this type of work.

B. Installer Qualifications:
1. The Structured Cabling Installer, as a business entity, shall be an authorized distributor to install, service and support Leviton/Berk-Tek, with full extended warranty privileges.
2. Company specializing in performing work of the type specified and with at least three (3) years of experience.
a. Upon request, Installer shall provide a reference list of five (5) similar scale projects and contact names confirming successful premises wiring system installations.
b. Recently formed companies which meet licensing and authorization requirements may be accepted at discretion of Architect/Engineer, subject to pre-approval based on experience of key personnel, current and complete projects. Submit request for approval at least 10 working days prior to the contract proposal date.
3. The Structured Cabling System Installer shall be licensed and shall meet all applicable regulations of the State of Texas, Department(s) of Labor, and all other applicable Authorities Having Jurisdiction in so far as they apply to this type of system.
4. Installer shall have an office within 100 miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owner’s representatives in the proper operation of the system, and to provide service throughout the warranty period.
a. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.
5. Installer shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this training shall be provided with the Installer’s submittal.
6. Structured Cabling System installation shall be performed under direct supervision of BICSI Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
7. Testing Supervisor: Installer's RCDD shall supervise on-site testing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until 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.

1.9 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.10 WARRANTY

A. The selected system installer shall be factory-certified and shall provide an end-to-end performance warranty issued by the manufacturer with a term of not less than fifteen (15) years.

B. The system warranty shall cover the components and labor associated with the repair/replacement of any failed link as a result of a defective product when a valid warranty claim is submitted within the warranty period.

C. The warranty shall cover all fiber optic cabling installed under this contract, with testing in accordance with the manufacturer's requirements.
1. Single-mode fiber shall be tested in accordance with ANSI/TIA-526-7 Method B.
2. Multi-mode fiber shall be tested in accordance with ANSI/TIA-526-14 Method B.

D. The warranty shall cover all twisted pair copper cabling installed under this contract, with testing in accordance with manufacturer's requirements.
1. Warranty shall stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA-568 (SET), or EN 50173. Quality and workmanship evaluation shall be solely by the Owner and designated representatives.
2. Copper horizontal cabling shall be tested bi-directionally (end-to-end) using a Level 2 tester per TIA/EIA-TSB-67.

E. Upon completion of the project, the Owner’s technical representative will perform a final inspection of the installed cabling system with the Contractor’s project foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the Drawings, and that the installation meets the aesthetic expectations of the customer.

F. Upon receipt of the test documentation, the Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the Contractor, and minor variations will be allowed to account for differences in test equipment and test variability. If significant discrepancies are found, the contractor will be notified for resolution.

G. In addition to the cabling system manufacturer warranty, Contractor shall warrant the cabling system against defects in workmanship for a period of two years from the date of system acceptance. Warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within original installation specifications after repairs are accomplished.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Work of this section covers a complete installation of all permanent links for a data and voice communications network utilizing copper and fiber transmission media that includes, but is not limited to the following:
1. Cabling as specified

2. Cable connectors, communications outlets and terminations as specified.
3. Equipment racks/cabinets for networking hardware and patch panels.
4. Rack- and wall-mounted horizontal- and vertical cable support devices
5. Furnish all labor, materials, tools, equipment and services for the installation described herein.
6. Cable pathways and runs to individual outlets are not shown in their entirety, but shall be provided as if shown in their entirety.
7. Coordinate with electrical tradespersons to verify conduit routing does not cause cabling to exceed specified electrical length.
8. Follow industry standard installation procedures for communications cable to assure that the mechanical and electrical transmission characteristics of this cable plant and equipment are maintained.
9. Furnish and install all patch cables as specified
10. Coordinate with Division 23 for interface with building instrumentation and control system.
11. Coordinate with Division 26 for power, rough-in, conduit and pathways.
12. Coordinate with Division 28 for cabling and interface with electronic safety and security systems.

B. The cabling system shall be backed by a fifteen (15) year Manufacturer system warranty. The system warranty shall be facilitated by the Contractor and be established between the Owner and the cabling system manufacturer.

C. Provide fiber backbone cabling from MDF to each IDF.
1. One (1) 12-strand single-mode fiber and
2. Two (2) 4-pair category 6 copper cables.

2.2 MANUFACTURERS

A. Subject to requirements, provide a structured cabling system as manufactured by Leviton/Berk-Tek.

2.3 OPTICAL FIBER

A. Refer to section 27 13 23 - Communications Optical Fiber Backbone Cabling for product specifications related to fiber backbone cabling.

2.4 BALANCED TWISTED-PAIR COPPER

A. Refer to section 27 15 13 - Communications Copper Horizontal Cabling for product specifications related to copper balanced twisted pair horizontal cabling.

PART 3 EXECUTION

3.1 STRUCTURED CABLING SYSTEM INSTALLATION

A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

B. Provide and install all equipment mounting racks, cabinets and/or brackets.

C. Provide, install, terminate, test, and document all fiber, copper voice, and data horizontal cable.

D. Allowable Cable Bend Radius and Pull Tension:
1. In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation.

2. Refer to cable manufacturer's bend radius recommendations for the maximum allowable limits.
3. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.

E. Provide and place all termination devices such as, but not limited to, modular patch panels, termination blocks, information outlets (jacks and plates), phone jacks, fiber distribution panels, bulkheads, connectors, and fiber fan out kits. Document all termination devices with proper labeling.

F. Pull Strings:
1. Horizontal cable requirements
   a. Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract.
   b. Pull string shall have a rated average breaking strength of 200 lbs.
   c. Data and video cables can be pulled in tandem with pull strings.
   d. During pulling sessions, pull strings must move freely to prevent cable jacket/cable damage.

G. Conduit Fill: Reference manufacturer's Design Installation Guidelines manual, BICSI TDMM, and NEC. The most stringent applicable code or standard shall apply.

H. All material and equipment as provided should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products.
1. All material and equipment shall be typical commercial designs that comply with the requirements specified.
2. All material and equipment shall be readily available through manufacturers and/or distributors.

I. All equipment shall be standard catalogued items of the manufacturer and shall be supplied complete with any optional items required for proper installation.

J. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility.

K. Expansion Capability: Unless otherwise indicated, provide spare conductor pairs in cables, positions in patch panels, cross connects, and terminal strips, and space in cable pathways and backboard layouts to accommodate 20% future increase in campus distribution and active workstations.

L. Backward Compatibility: The provided solution shall be backward compatible with lower category ratings such that if higher category components are used with lower category components, the basic link and channel measures shall meet or exceed the lower channel’s specified parameters.

M. Component Compliance: The provided solution’s components shall each meet the minimum transmission specifications listed herein such that no individual component will be less than specifications for permanent link and channel, regardless of the fact that tests for link and channel ultimately meet required specifications.

N. In the event of a breach of the representations and warranties contained herein, the Contractor, at their own expense, shall take all measures necessary to make the cabling system work and comply with the applicable manufacturer written technical recommendations and standards.

O. Provide and install UL-approved firestopping systems in all communication pass-throughs, conduits and cable trays, and ceiling, wall and floor penetrations in coordination with General Contractor.

P. All grounding and bonding in communications rooms shall be bonded to ground bus provided by Division 26.

Q. Owner’s technical representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling to inspect the method of cable routing and support and the firestopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with the ANSI/TIA-568-C standards for jacket removal and pair untwist, compliance with manufacturer’s minimum bend radius, and that cable ends are dressed neatly and orderly.

3.2 OPTION TO RELOCATE DEVICES

A. The location of voice and data outlets and other similar devices along with their associated connections may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to rough-in or installation.

3.3 LABELING

A. See Section 27 00 00 - Common Communications Requirements for color coding, cable label specifications, and flat surface label specifications.

B. Provide transparent plastic label holders, and 4-pair marked colored labels.

C. Install colored labels according to the type of field as per ANSI/TIA 606-A color code designations.

D. Use ANSI/TIA 606-A: “designation strip color-code guidelines for voice, data, cross- connect, riser, and backbone fields”

E. Cable and Wire Identification:
1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Label each unit and field within distribution racks and frames.
3. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
4. Labeling shall note cable type, run designation, “Tx” for transmit fiber connectors, and “Rx” for the receive fiber connectors.
5. Cable labels shall not be obscured from view.
6. All labeling shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

F. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

G. Identifier & Numbering Formats

1. All identifiers shall incorporate room numbers from the final Owner's room numbering scheme. Coordinate with Owner to obtain final room numbers prior to applying labels.
2. Backbone Cable ID: [Origin Rm.]-[Destination Rm.] [Media Type].[Strand Count]
   e.g. 12-strand OS2 fiber running from MDF A100 to IDF B125 would have the identifier "A100-B125 OS2.12"
3. Horizontal Cabling Outlet ID: [Outlet Rm]-[Location in Room][Outlet Type][Cable Number]
   a. Location in room: Assign sequential numbers to data outlets in a clockwise direction, starting from the room entry door.
   b. Outlet Type: D for data, C for camera, W for WAP, etc.
      e.g. The second data port in a plate at the first location clockwise from the door of Room C216 would be C216-1D2.
4. TR Patch Panel ID: [Room Number]-[Patch Panel Letter]
   a. Patch Panel Letter: Letters shall be assigned starting with panel A in the top rack space of the rack nearest the wall.
      e.g. The third patch panel from the top of the rack nearest the wall in IDF B125 would have the identifier B125-C

3.4 CLOSEOUT ACTIVITIES

A. O&M Submittal:
   1. Provide indexed and organized complete Test Results of all copper and fiber cable and their components.
   2. Cabling Administration Drawings:
      a. Show building floor plans with cabling administration-point labeling.
      b. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
      c. Follow convention of TIA/EIA-606-A.
      d. Furnish electronic record of all drawings, in software and format selected by Owner.

B. Warranty:
   1. After installation and testing, Contractor shall prepare and submit all documentation to support the warranty in accordance with the manufacturer's warranty requirements, including test results, and apply for said warranty on behalf of the Owner.
   2. Provide an end-to-end performance warranty of not less than fifteen (15) years for this wiring system.

END OF SECTION

SECTION 27 11 00 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Backboards.
2. Boxes, enclosures, and cabinets.
3. Cable trays.

B. Related Requirements:
1. Division 26 Section “Raceways and Boxes for Electrical Systems” for backbox and device boxes for communication outlets.
2. Division 26 Section "Pathways for Communications Systems" for j-hooks, boxes, conduits, and accessories.
3. Division 27 Section "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
4. Division 27 Section "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

C. DEFINITIONS
1. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.
2. BICSI: Building Industry Consulting Service International.
3. RCDD: Registered communications distribution designer.
4. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.
5. SBB: Telecommunications Secondary Bonding Busbar.
6. PBB: Telecommunications Primary Bonding Busbar.
7. UON: Unless otherwise noted

1.2 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 27 Section “Communications Shop Drawings and Submittals” for products specified under PART 2 - PRODUCTS.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 27 Section “Communications Shop Drawings and Submittals”.

C. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include data indicating dimensions and finishes for each type of cable tray indicated.

D. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
4. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
   a. Vertical and horizontal offsets and transitions.
   b. Clearances for access above and to sides of cable trays.
   c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
   d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Refer to Quality Assurance information in Division 27 Section "Scope of the Communications Work" for additional information.

B. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as RCDD to perform the on-site inspection.

PART 2 PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

B. Backboard Paint: Light-colored fire-retardant paint.

2.2 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Hubbell Incorporated; Wiring Device-Kellems.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets:
1. Boxes, enclosures, and cabinets shall be listed and labeled for intended location and use.
2. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
3. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
4. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

5. Device Box Dimensions: 4 inches square by 2-1/8 inches deep, UON.

C. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

2.3 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

B. Source Limitations: Obtain cable trays and components from single manufacturer.

C. Sizes and Configurations: See Drawings for specific requirements for types, materials, sizes, and configurations.

D. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.4 LADDER CABLE RUNWAY

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
1. B-Lline.
2. Belden.
3. Chatsworth Products, Inc. (CPI).

B. Description:
1. Configuration: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1.
2. Width: 12 inches unless otherwise indicated on Drawings.
3. Straight Section Lengths: 10 feet, except where shorter lengths are required to facilitate tray assembly.
4. Rung Spacing: 12 inches o.c.
5. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
6. Minimum Cable-Bearing Surface for Rungs: 7/8-inch width with radius edges.
7. No portion of the rungs shall protrude below the bottom plane of side rails.
8. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb concentrated load, when tested according to NEMA VE 1.
9. Fitting Minimum Radius: 24 inches.
10. Splicing Assemblies: Bolted type using serrated flange locknuts.
11. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

C. Materials and Finishes:
1. Steel:
a. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.

b. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
c. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
d. Finish: Epoxy-resin paint.
   1) Epoxy-Resin Prime Coat: Cold-curing epoxy primer, MPI# 101.
   2) Epoxy-Resin Topcoat: Epoxy, cold-cured gloss, MPI# 77.
   3) Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

D. Basis-of-Design Chatsworth Components:

Description	Part Number
Chatsworth 12” Ladder Rack	10250-712
Wall to Rack Ladder Kit	11911-712
Wall Angle kit	11421-712
Wall Triangular Support	11312-12
Rack to Runway	10595-712
Cable Runway Elevation Kit	10506-702
Butt Splice	11301-701
Junction-Splice	11302-701
Cable Runway Radius drop	12100-712
End cap	10642-001

2.5 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Barrier Strips: Same materials and finishes as for cable tray.

C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Comply with requirements in Division 26 Section "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in tracks and in room. Coordinate service entrance configuration with service provider.
1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Backboards:
1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.
2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards.
3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.3 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Fasten cable tray supports to building structure.

F. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

G. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

H. Support tray assembly to prevent twisting from eccentric loading.

I. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

J. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

K. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

L. Make changes in direction and elevation using manufacturer's recommended fittings.

M. Make cable tray connections using manufacturer's recommended fittings.

N. Seal penetrations through fire and smoke barriers. Comply with requirements in Division 07 Section "Penetration Firestopping."

O. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

P. Install cable trays with enough workspace to permit access for installing cables.

Q. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

R. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.4 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Division 26 Section "Grounding and Bonding."

B. Cable trays shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.5 CABLE INSTALLATION

A. Install cables only when each cable tray run has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. Fasten cables on vertical runs to cable trays every 18 inches.

D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches.

3.6 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Firestopping."

B. Comply with requirements in Division 27 Section “Common Communications Requirements.”

C. Comply with TIA-569-D, Annex A, "Firestopping."

D. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
   2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
   3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
   4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
   5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
   6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
   7. Check for improperly sized or installed bonding jumpers.
   8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
   9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.8 PROTECTION

A. Protect installed cable trays and cables.
   1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
   2. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

SECTION 27 11 16 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. 19-inch, 2-post network equipment racks.
   2. Vertical cable management assemblies.
   3. Horizontal cable management assemblies.
   4. Grounding.
   5. Labeling.

B. Related Requirements:
   1. Division 26 Section "Grounding and Bonding" for PBBs and SBBs.
   2. Division 26 Section "Pathways for Communications Systems" for j-hooks and conduit.
   3. Division 27 Section "Communications Equipment Room Fittings" for backboards, cable trays, cable tray accessories, power strips, UPSes, and accessories.
   4. Division 27 Section "Communications Optical Fiber Backbone Cabling" for optical-fiber data cabling associated with system panels and devices.
   5. Division 27 Section "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

1.2 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.
   1. RCDD: Registered communications distribution designer, a BICSI credential.

B. LAN: Local area network.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
   1. Main Cross-Connect (MC):Central cross-connect for backbone cabling to the ICs and HCs. Frequently co-located with the EF.
   2. Horizontal Cross-Connect (HC): Cross-connect facility providing backbone cabling termination and distribution for Horizontal Cabling.
   3. Intermediate Cross-Connect (IC): Cross-connect facility providing intermediate-level backbone cabling distribution.

D. Entry-Facility (EF): The facility where service cabling from telecom access providers or campus OSP distribution terminates, also known as the Demarcation Point or Demarc.

E. Equipment Room (ER): An environmentally controlled centralized space for telecommunications equipment. Frequently co-located with the MC or IC.

F. PBB: Primary Bonding Busbar.

G. SBB: Secondary Bonding Busbar.

H. Telecommunications Enclosure (TE): A self-contained enclosure that provides a secure location for connection between backbone and horizontal infrastructure.

I. Telecommunications Room (TR): A room (or space) that provides an environmentally suitable and secure location for the connection between backbone and horizontal infrastructure.

1.3 CABINETS, RACKS, FRAMES, AND ENCLOSURES DESCRIPTION:

A. The ER (MDF) and TRs (IDFs) shall house racks, cross-connect fields for backbone and horizontal cabling, and required cable routing hardware.

B. The ER (MDF) shall be equipped with 2-post 19-inch racks as shown on drawings.

C. Each typical TR (IDF) shall be equipped with 2-post 19-inch racks as shown on drawings.

D. Racks and cabinets shall be placed as shown on the drawings, and/or located in a manner that will allow a minimum of 3 feet of clearance from the front and 3 feet from the rear mounting surfaces and on one side.

E. Vertical cable management shall be provided along both sides of all two-post racks. Refer to drawings for layouts.

F. Horizontal cable management shall be provided within all equipment racks.

1.4 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 27 Section “Communications Shop Drawings and Submittals” for products specified under PART 2 - PRODUCTS.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 27 Section “Communications Shop Drawings and Submittals”.

C. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

D. Shop Drawings: For communications racks, frames, and enclosures. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of each bonding busbar on plans. Provide a mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.6 QUALITY ASSURANCE

A. Refer to Quality Assurance information in Division 27 Section “Scope of the Communications Work” for additional information.

B. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of RCDD.
   2. Installation Supervision: Installation shall be under direct supervision of Installer 2, Copper or Fiber, who shall be present at all times when Work of this Section is performed at Project site.
   3. Field Inspector: Currently registered by BICSI as RCDD to perform on-site inspection.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL listed.

B. RoHS compliant.

C. 19-inch rack width shall comply with EIA/ECIA 310-E, 19-inch nominal panel width with an opening of 17.72-inches between rails and mounting hardware

2.2 MANUFACTURERS

A. Subject to requirements, provide products manufactured by the following:
   1. Chatsworth Products, Inc. (CPI)
   2. Greatlakes
   3. Legrand Ortronics
   4. Others by Prior Engineer Approval.

2.3 19-INCH, TWO-POST NETWORK EQUIPMENT RACKS

A. Description: Freestanding, modular 19-Inch two-post racks with threaded (#12-24) rails designed for mounting telecommunications equipment.

B. Basis-of-Design Product: Provide Chatsworth #55053-703

C. Approved Manufacturers: Subject to compliance with requirements, provide products manufactured by:
   1. Chatsworth Products, Inc. (CPI).
   2. Great Lakes.
   3. Legrand Ortronics.
   or Engineer-approved equal.

D. Appearance and Finishes:
   1. Finish: Manufacturer's standard, baked-polyester powder coat. Color: Black.
   2. Rack Units Marked and Numbered in contrasting color.

E. Physical Characteristics:
   1. Overall Dimensions: 84"H x 20.3"W x 15"D (including mounting flanges).
   2. Upright Channel Depth: 3inches
   3. Load Rating: 1000 lb. of equipment.
   4. Equipment space: 45RU
   5. Universal hole pattern, 5/8" - 5/8" - 1/2" vertical spacing.
   6. Grounding/bonding lug inside side channel with prepared bare metal attachment point.
   7. Base shall have a minimum of four mounting holes for permanent attachment to floor.
   8. Top shall have provisions for attaching to cable tray or ceiling.

9. Self-leveling.

2.4 VERTICAL CABLE MANAGEMENT:

A. Description: 10" wide double-sided metal-channel vertical cable managers with front door.

B. Basis-of-Design Products: Subject to compliance with requirements, provide the following,:
1. 10-inch cable manager: Chatsworth #30166-703.
2. 6-inch cable manager: Chatsworth #30165-703.
3. Comparable products by same manufacturer as racks.

C. Physical Characteristics:Metal, with integral wire retaining fingers.
1. 10-inch wide aluminum channel (all managers on project to be 10-inch).
2. Flexible composite cable management fingers.
3. Double-sided finger-type cable management configuration type.
4. Front door with access from right or left and 180 degree swing.

D. Appearance and Finishes:Baked-polyester powder coat finish.
1. Finish: Manufacturer's standard, baked-polyester powder coat. Color: Black

E. All two-post equipment racks shall be augmented with vertical cable management hardware, both front and rear, to properly dress cables and patch cords.

2.5 HORIZONTAL CABLE MANAGEMENT:

A. Description: 2RU double-sided composite horizontal cable managers with front and back covers.

B. Approved Products: Subject to compliance with requirements, provide:
1. Chatsworth Evolution series.
2. Comparable products by same manufacturer as racks.

C. Physical Characteristics
1. Composite construction.
2. Flexible composite cable management fingers.
3. Removable hinged covers open to both top and bottom.
4. Pass-thru holes for routing cable between front and back of rack.

D. All equipment racks shall be augmented with horizontal cable management hardware, both front and rear, to properly dress cables and patch cords.

2.6 CATEGORY 6 PATCH PANELS:

A. Description: Termination for copper horizontal cabling shall consist of Category 6 patch panels with the following characteristics:
1. Medium density (1RU, 24-port and 2RU, 48 port) flat front configuration
2. Data patch panels: 48-port.
3. Other applications patch panels: 24-port.
4. Terminated in T568B configuration.

B. Category 6 Products: Subject to compliance with requirements, provide:
1. Leviton QuickPort #49255-H24 (1RU 24-Port).
2. Leviton QuickPort #49255-H48 (2RU 48-Port).

C. Each panel shall be black in color with individual ports numbered sequentially, from left to right, top to bottom. All ports shall be labeled 01-48, below the port.

D. An additional label area shall be provided immediately adjacent to each port to allow for room number labeling at each port.

E. A separate patch panel shall be provided for IP based video surveillance cameras.

F. Separate patch panels shall be provided for wireless access point drops.

2.7 FIBER OPTIC PATCH PANELS

A. Description: Rack- and/or wall- mounted enclosures providing protection for terminated backbone fiber and cross-connection cabling.

B. Approved Products: Subject to compliance with requirements, provide:
1. Leviton #5R1UH-S03 (1RU, 3 Splice Tray Sliding Enclosure).
2. Leviton #5R2UH-S06 (2RU, 6 Splice Tray Sliding Enclosure).
3. Leviton #5WSML-02C (Wall Enclosure for OSP).

C. Physical Characteristics:
1. Housings shall be manufactured using 16-gauge aluminum or equivalent for structural integrity and shall be finished with a wrinkled black powder coat for durability. All fasteners shall be black-chromate to match the housing.
2. The unit shall have guides that allow a transition and segregation point for jumpers exiting the sides of the housing.
3. Wall-mount panels shall have (2) separate compartments, one for splice tray terminations and one for patch cables. Each compartment shall have a door.

D. Functional Characteristics:
1. Each connector shall be held by a duplex coupler snap-in adapter plate. Adapter plates shall be installed into rack-mount fiber optic enclosure. Refer to fiber backbone cabling section for specifications.
2. Enclosures shall be designed to protect against bend radius violations.
3. Enclosures shall ensure that cable routing paths for all fibers are clear and cable congestion is minimized.
4. The unit shall be modular with separate splicing, connector and jumper management housings available.
5. The rack-mounted housings shall meet the requirements of TIA/EIA-568-A and UL V-0.
6. The connector housings shall have a labeling scheme that complies with TIA/EIA-606.

2.8 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Labeling software shall be able to produce complex unique identifiers of up to 12 independent segments. Labeling software shall be capable of inserting symbols and any standard true type font as well as capable of saving individual build information and fine-tuning print adjustments.

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout of communications equipment spaces and BICSI ITSIMM for installation of communications equipment spaces.

C. Install all systems in accordance with manufacturer’s printed instructions.

D. Horizontal data terminations shall be contained in 19” x 84” racks. All equipment racks shall be augmented with horizontal and vertical cable management hardware, both front and rear, to properly dress horizontal cables and patch cables.

E. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

F. Coordinate layout and installation of communications equipment in racks and room. Coordinate service entrance configuration with service provider.
1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames in equipment spaces to accommodate Owner's requirements and optimize configuration.

G. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

H. Floor-mounted racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If the mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6 inches to the wall to allow room for vertical management. Where there is more than one rack, the racks shall be ganged with vertical management hardware to provide cable management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side of the ganged assembly. Request clarification from Engineer if the drawings conflict with the instructions above.

3.2 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with NECA/BICSI 607.

C. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection" Chapter.

D. Locate SBB to minimize length of bonding conductors. Fasten to wall, allowing at least 2 inches of clearance behind SBB. Connect SBB with a minimum No. 2 AWG grounding electrode conductor from SBB to suitable electrical building ground. Connect rack ground bar kit to near SBB or the PBB.
1. Bond the shield of shielded cable to patch panel, and bond patch panel to SBB or PBB.

3.3 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Comply with requirements in Division 09 Section "Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration.

D. Label patch panels with patch panel ID as defined in section 27 10 00 Part 3.

E. Label port fields on backbone cabling patch panels with the backbone cable ID as defined in section 27 10 00 Part 3.

F. Label populated ports on horizontal cabling patch panels with the horizontal cabling outlet ID as defined in section 27 10 00 Part 3.

G. Labels shall be machine printed. Font type shall be 3/16 inch in height.

H. All labeling shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

I. All labels shall incorporate room numbers from the final Owner’s room numbering scheme. Coordinate with Owner to obtain final room numbers prior to applying labels.

END OF SECTION

SECTION 27 13 23 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. 9/125 micrometer single-mode optical fiber cable, plenum rated (OS2).
2. Optical fiber cable connecting hardware, patch panels, and cross-connects.
3. Cabling identification products.

B. Related Requirements:
1. Division 26 Section "Grounding and Bonding" for Grounding and Bonding Busbars.
2. Division 26 Section "Pathways for Communications Systems" for j-hooks and conduit.
3. Section 27 10 00 - Structured Cabling Common Requirements for Structured Cabling System installer qualifications, testing, reporting, closeout procedures, and warranty requirements.
4. Section 27 11 16 - Communications Racks, Frames, and Enclosures for fiber patch enclosures.

1.2 REFERENCED STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

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

C. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement; 2015a (Reaffirmed 2022).

D. TIA-568.1 - Commercial Building Telecommunications Infrastructure Standard; 2020e.

E. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.

F. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

G. TIA-604-10 - FOCIS 10 Fiber Optic Connector Intermateability Standard- Type LC; 2021c.

H. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).

I. UL 444 - Communications Cables; Current Edition, Including All Revisions.

J. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

1.3 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Intrabuilding Backbone cabling from MC to each HC shall be OS2 single-mode indoor optical fiber cable with interlocking armored plenum outer jacket.

B. Cabling from MC to marquee sign shall be OS2 single-mode OSP fiber cable with interlocking armored outer jacket.

C. Optical fiber backbone cabling system shall provide connections between the communications MC and the EF, HC(s), and ERs in the telecommunications cabling system structure in a star topology.

D. Cabling system consists of backbone cables, cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection and/or backbone-to-equipment interconnection.

E. Backbone cabling cross-connects may be located in TRs, TEs, ERs and/or at EFs. Bridged taps and splitters shall not be used as part of backbone cabling.

1.4 ACTION SUBMITTALS

A. Submit product data and shop drawing Action Submittals in accordance with Division 01, 27 05 03 - Communications Shop Drawings and Submittals, and 27 10 00 - Structured Cabling Common Requirements.

1.5 CLOSEOUT SUBMITTALS

A. Submit warranty and testing documentation and operation and maintenance data in accordance with Division 01, 27 05 03 - Communications Shop Drawings and Submittals, and 27 10 00 - Structured Cabling Common Requirements.

B. Refer to Part 3 - Execution for optical fiber testing requirements.

1.6 QUALITY ASSURANCE

A. Refer to Quality Assurance information in Sections 27 05 10 - Scope of the Communications Work and 27 10 00 - Structured Cabling Common Requirements for requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test optical fiber cable while on reels. Use an OTDR to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.

1.8 WARRANTY

A. The selected system installer shall be factory-certified and shall provide an end-to-end performance warranty issued by the manufacturer with a term of not less than twenty-five (25) years. Refer to section 27 10 00 - Structured Cabling Common Requirements for detailed requirements.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569.

D. Grounding: Comply with TIA-607.

2.2 MANUFACTURERS

A. Subject to requirements, provide fiber backbone products manufactured by:
1. Corning
2. Leviton/Berk Tek
3. Substitutions by prior Engineer approval only.

2.3 9/125 MICROMETER, SINGLE-MODE, INDOOR PLENUM OPTICAL FIBER CABLE (OS2)

A. Description: Single mode, 9/125-micrometer, tight buffered optical fiber cable with plenum rated jacket.

B. Armored Cable: Subject to compliance with requirements, provide:
1. Corning #12E88-33131-A3
2. Leviton / Berk Tek #PDPK012

C. Part numbers provided above are for 12-strand cable; refer to structured cabling riser for strand counts. Provide Manufacturer's direct replacement if the specified product is discontinued.

D. Standards:
1. Comply with TIA-492CAAB for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-83-596 for mechanical properties.

E. Construction:
1. Jacket Color: Yellow.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

F. Maximum Attenuation: 0.7 dB/km at 1310 nm; 0.7 dB/km at 1550 nm.

G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 , UL 1651, and NFPA 70 for the following types:

2.4 9/125 MICROMETER, SINGLE-MODE, INDOOR/OUTDOOR PLENUM OPTICAL FIBER CABLE (OS2)

A. Description: Single mode, 9/125-micrometer, tight buffered interlocking armor optical fiber cable with plenum-rated indoor/outdoor hybrid jacket.

B. Armored Cable: Subject to compliance with requirements, provide:
1. Corning #006E8P-31131-A3
2. Leviton / Berk-Tek #PDPK006-I/O-C4C5

C. Part numbers provided above are for 6-strand cable; refer to structured cabling riser for strand counts. Provide Manufacturer's direct replacement if the specified product is discontinued.

D. Standards
1. Comply with TIA-492CAAB for detailed specifications.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with ICEA S-104-696 for mechanical properties.

E. Construction
1. Jacket Color: Black.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

F. Maximum Attenuation: 0.7 dB/km at 1310 nm; 0.7 dB/km at 1550 nm.

G. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
1. Plenum Rated, Armored (Conductive): Type OFCP

2.5 OPTICAL FIBER CABLE HARDWARE

A. Standards:
1. Comply with Fiber Optic Connector Intermateability Standard (FOCIS) specifications of the TIA-604 series.
2. Comply with TIA-568.3.

B. Connector Type: Type LC complying with TIA-604-10.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

D. Patch Cords:
1. Factory-made, fiber optic cable assemblies using duplex cable.
2. Patch cord assemblies shall be LC to LC, 3-meter length.

2.6 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with TIA-607-B and NECA/BICSI-607.

2.7 INNER DUCT

A. Description: Corrugated non-metallic flexible raceway for separation and protection of fiber optic cabling.

B. Corrugated tubing, size as noted. Color Orange U.O.N.

C. Factory pre-installed pull tape.

D. Approved manufacturers:
1. Carlon
2. Dura-line

E. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 910, and NFPA 70, rated for use in environmental air handling plenum.

2.8 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Labeling software shall be able to produce complex unique identifiers of up to 12 independent segments. Labeling software shall be capable of inserting symbols and any standard true type font as well as capable of saving individual build information and fine-tuning print adjustments.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test single mode optical fiber cables according to TIA-526-7 and TIA-568.3.

C. Cable will be considered defective if it does not pass tests and inspections and must be replaced.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements of demarcation point, cabinets, and racks specified in Division 27 Section “Communications Racks, Frames, and Enclosures.”

B. Comply with Division 26 Section “Pathways for Communications Systems.”

C. Drawings indicate general arrangement of pathways and fittings.

3.3 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
   1. Comply with requirements for pathways specified in Division 26 Section "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

D. Non-armored fiber optic cabling shall be installed in inner duct, u.o.n.

3.4 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. General Requirements for Optical Fiber Cabling Installation:
   1. Comply with TIA-568.1 and TIA-568.3.
   2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
   3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   4. Cables may not be spliced. 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.
   5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
   7. 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.
   8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
   9. In the communications equipment room, provide a 10-foot-long service loop on each end of cable.
   10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
   11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
   12. Backbone cables shall be installed separately from horizontal distribution cables. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits.
   13. Where cables are installed in air return plenums, the backbone cable shall be installed in conduit to provide protection of cable. Backbone cables shall be installed in separate conduits from horizontal distribution cables.
   14. Cable shall be installed in innerduct from fiber patch panels to plenum entrances. Innerduct shall not be installed in plenum ceilings unless it is UL approved plenum rated. Plenum rated cable shall be installed in conduit or UL approved plenum rated innerduct in all plenum ceilings.
   15. Inside plant cables above four fibers shall support a minimum bend radius of 10 times the cable diameter under no tensile load and 20 times the cable diameter under tensile loading to the cable’s rated limit.

B. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
   3. Where backbone cables and distribution cables are installed in a cable tray or j-hooks, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

C. Group connecting hardware for cables into separate logical fields.

D. Terminations: Terminations shall be performed by manufacturer-trained and certified technicians. Terminations shall be made in a controlled environment. Contractor may choose to have cables assembled off-site, although testing must be completed with the cable in its final installed condition.

E. Warning Tags: At each location where fiber cable is exposed to human intrusion, it shall be clearly marked with waring tags. These tags shall be yellow or orange in color and shall contain the warning: “CAUTION FIBER OPTIC CABLE”. The text shall be permanent, black, block characters, and at least 3/16-inch high. A warning tag shall be permanently affixed to each exposed cable or bundle of cables at intervals of not less than five (5) feet. Any section of exposed cable that is less than five (5) feet in length shall have at least one warning tag affixed to it.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Firestopping."

B. Comply with requirements in Division 27 Section “Common Communications Requirements.”

C. Comply with TIA-569, Annex A, "Firestopping."

D. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.6 GROUNDING

A. Install grounding according to BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter.

B. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 2 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

C. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

D. Bond conductive cable armor to the telecom grounding system per ANSI-J-STD-607 and NEC.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in the OSDM Communication and Network Systems Telecommunications Standards. The identification scheme will be provided by the Owner.

B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

D. Cable and Wire Identification:
1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Exposed Cables and Cables in Cable Trays and J-hooks: Label each cable at intervals not exceeding 15 feet.
3. Label each unit and field within distribution racks and frames.
4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
5. Labeling shall note cable type, run designation, “Tx” for transmit fiber connectors, and “Rx” for the receive fiber connectors.
6. Cable labels shall not be obscured from view.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
1. Flexible vinyl or polyester that flexes as cables are bent.
2. Labels shall be machine printed. Type shall be 3/16 inch in height.

F. Label backbone cabling with the backbone cable ID as defined in section 27 10 00 Part 3. Refer to section 27 11 16 for labeling of patch panels.

G. All labeling shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

H. All labels shall incorporate room numbers from the final Owner’s room numbering scheme. Coordinate with Owner to obtain final room numbers prior to applying labels.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative

B. Tests and Inspections:
1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
b. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test trace and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
c. All fiber optic cable shall be tested on the reel before installation to ensure that is meets the specifications outlined herein.
d. After installation, test each fiber strand in accordance with the EIA 455-171 Method D procedures (bi-directional testing) at both 850 and 1300 nm for multimode and 1310nm and 1550nm for single-mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
e. Single-mode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 db/km at 1550 nm
f. Multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm.
g. Acceptable fiber optic connector loss shall not exceed 0.75 dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer’s specifications.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.

G. OTDR shots shall be provided for each strand of fiber completely installed and terminated.

H. Prepare test and inspection reports.

3.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer’s original, unopened, protective containers and packaging, with labels clearly identifying product name and manufacturer.
1. Store materials in secure, clean, and dry area indoors in accordance with manufacturer’s instructions.
2. Protect materials and finish from damage and moisture during handling and installation.

END OF SECTION

SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Category 6 twisted pair cable.
2. Twisted pair cable hardware, including plugs and jacks.
3. Cabling identification products.
4. Grounding provisions for twisted pair cable.
5. Source quality control requirements for twisted pair cable.

B. DEFINITIONS
1. FTP: Shielded twisted pair.
2. F/FTP: Overall foil screened cable with foil screened twisted pair.
3. F/UTP: Overall foil screened cable with unscreened twisted pair.
4. IDC: Insulation displacement connector.
5. Jack: Commonly called an "outlet," it is the fixed, female connector.
6. Plug: Commonly called a "connector," it is the removable, male telecommunications connector.
7. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
8. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.
9. S/FTP: Overall braid screened cable with foil screened twisted pair.
10. S/UTP: Overall braid screened cable with unscreened twisted pairs.
11. UTP: Unscreened (unshielded) twisted pair.

1.2 REFERENCED STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. ISO/IEC 11801-1 - Information Technology – Generic Cabling for Customer Premises – Part 1: General Requirements; 2017 (Corrigendum 2018).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

E. TIA TSB-184 - Guidelines for Supporting Power Delivery over Balanced Twisted-Pair Cabling; Rev. A (2017).

F. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.

G. TIA-568.1 - Commercial Building Telecommunications Infrastructure Standard; 2020e.

H. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

I. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

J. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

K. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).

L. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

M. UL 1685 - Standard for Safety Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables; Current Edition, Including All Revisions.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cabling for data circuits shall be Category 6, 24 AWG, 4-pair UTP, UL/NEC CMP rated and independently verified for compliance.

B. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
1. TIA-568.1 requires that a minimum of two equipment outlets be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

C. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.

D. The maximum allowable horizontal cable length is 275 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

E. The horizontal cabling shall extend from each designated data outlet to the nearest IDF or the MDF in a star topology.

1.4 ACTION SUBMITTALS

A. Submit product data and shop drawing Action Submittals in accordance with Division 01, 27 05 03 - Communications Shop Drawings and Submittals, and 27 10 00 - Structured Cabling Common Requirements.

1.5 CLOSEOUT SUBMITTALS

A. Submit warranty and testing documentation and operation and maintenance data in accordance with Division 01, 27 05 03 - Communications Shop Drawings and Submittals, and 27 10 00 - Structured Cabling Common Requirements.

B. Refer to Part 3 - Execution for cable testing requirements.

1.6 QUALITY ASSURANCE

A. Refer to Quality Assurance information in Sections 27 05 10 - Scope of the Communications Work and 27 10 00 - Structured Cabling Common Requirements for requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test each pair of twisted pair cable for open and short circuits.

1.8 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.9 WARRANTY

A. The selected system installer shall be factory-certified and shall provide an end-to-end performance warranty issued by the manufacturer with a term of not less than twenty-five (25) years. Refer to section 27 10 00 - Structured Cabling Common Requirements for detailed requirements.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569.

C. Grounding: Comply with TIA-607.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
   1. Communications, Plenum Rated: Type CMP complying with UL 1685.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, with internal spline, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.

B. Indoor Cabling Product: Subject to requirements, provide cabling from the following product series:
   1. Berk-Tek LANMARK series.

C. Indoor/Outdoor Cabling Product: Subject to requirements, provide cabling from the following product series:

D. Physical Characteristics:

1. Conductor Gauge: 23 AWG
2. Nominal Outside Diameter: 0.222 in
3. Separator Type: Isolator
4. Shielding/Screening: None (UTP)
5. Environmental Rating: Plenum (CMP)
6. Jacket Color: Color code by application per color code article in this section.

E. Performance Characteristics:
1. Characteristic Impedance: 100-ohm.
2. Operating Frequency: 250 MHz.
3. Transmission Standards: TIA-568.2 Cat 6, ISO/IEC 11801-1 Class E.
4. Remote Power: IEEE 802.3bt compliant when installed according to TIA TSB-184.

2.4 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturer: Subject to compliance with requirements, provide products by the following:
1. Leviton.
2. Semtron (Faceplates)

C. General Requirements for Twisted Pair Cable Hardware:
1. Comply with the performance requirements of Category 6, as applicable to the specified cabling.
2. Comply with ANSI/TIA-568-2.D, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from same manufacturer as twisted pair cable, from single source.

E. Patch Cables: Factory-made, four-pair cables; terminated with an 8P8C modular plug at each end.
1. Patch cables shall have bend-relief-compliant boots and color-coded icons to ensure performance.
2. Cable assemblies shall meet the performance requirements of ANSI/TIA-568-2.D
3. Cable assemblies shall utilize the color scheme defined above.
4. Provide one (1) 10-foot workstation/device patch cable and one (1) 10-foot distribution frame patch cable per installed data or telephone jack indicated on plans.
5. For wireless access points, provide one (1) 10-foot workstation/device patch cable and one (1) 10-foot distribution frame patch cable per installed WAP drop indicated on plans.
6. For IP video surveillance cameras, provide a one (1) 10-foot workstation/device patch cable and one (1) 10-foot distribution frame patch cable per installed data or telephone jack indicated on plans.

F. Plugs and Plug Assemblies:
1. Male; eight-position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-2.D.
3. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:
1. Female; eight-position; modular using connectors designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.

2. Insulation displacement connectors (IDC) shall be capable of terminating 22-24 AWG solid or 24 AWG stranded conductors. The insulation displacement contacts shall be paired with additional space between pairs to improve crosstalk performance.
3. Designed to snap-in to a patch panel or faceplate.
4. Standard: Comply with TIA-568-2.D requirements.
5. Marked to indicate transmission performance.
6. Jacks installed in faceplates shall match the color of the cable per the type of system as defined above.
7. The number next to data symbol on Drawings indicates the quantity of data lines/jacks at that location, duplex outlets are not numbered. One jack shall be provided at the end of each cable run.

H. Faceplate: Each data or telephone jack shall be terminated and mounted in a suitable faceplate for all wall, enclosure, millwork, floor box, modular furniture, etc. locations.
1. Four-port, vertical single gang faceplates designed to mount to single gang wall boxes. Faceplate shall match manufacturer for jacks at all locations. Provide blank insert covers for unused station ports.
2. Above ceiling should have a two-port plenum surface box.
3. Faceplate:
   a. Provide stainless steel plates for use with snap-in jacks. Jacks shall be held flat to plane of faceplate.
   b. Plates shall accommodate any combination of twisted pair, optical fiber, and coaxial work area cords.
   c. Plates shall include label positions.
   d. Plates shall complying with general faceplate requirements in Division 26 Section "Wiring Devices."
   e. Product: Subject to requirements, provide Semtron #1FM-(4)0E-AMP-LAB
4. Wall Telephone Station Jack:
   a. Provide a Stainless steel wall plate for use with one (1) snap-in jack, with telephone wall set mounting studs and without label position(s).
   b. Product: Subject to requirements, provide Semtron #1FM-OE-AMP-PHONE

I. Legend:
1. Machine printed, in the field, using adhesive-tape label.
2. Snap-in, clear-label covers and machine-printed paper inserts.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Labeling software shall be able to produce complex unique identifiers of up to 12 independent segments. Labeling software shall be capable of inserting symbols and any standard true type font as well as capable of saving individual build information and fine-tuning print adjustments.

2.6 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.7 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA-568.1.

C. Factory test twisted pair cables according to TIA-568.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways, cable trays, and J-hooks, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Pathways for Communications Systems."

B. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements for demarcation point, cabinets, racks, and cable trays specified in Division 27 Section "Communications Equipment Room Fittings."

B. Comply with Division 26 Section "Pathways for Communications Systems."

C. Drawings indicate general arrangement of pathways and fittings.

3.3 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. General Requirements for Cabling:
1. Comply with TIA-568.0, TIA-568.1, and TIA-568.2.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Cable pathways, conduit, and cable support systems shall be complete with bushings, deburred, cleaned, and secure prior to installation of cable.
4. Cables shall be dressed and terminated in accordance with the recommendations in ANSI/TIA-568 standard, manufacturer’s recommendations, and/or best industry practices.
5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels. Cable jacket shall be maintained as close as possible to the termination point.
6. Do not untwist twisted pair cables more than 1/4 inch from the point of termination to maintain cable geometry.
7. Cables shall be neatly bundled and dressed to their respective panels.
8. Each panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack.

9. Consolidation points may be used only for making a direct connection to equipment outlets:
    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.
10. Cables may not be spliced. 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.
11. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
12. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
13. 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.
14. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
15. Service Loops:
    a. Provide 6-foot-long service loop on MDF/IDF end of all cabling.
    b. Provide 3-foot-long service loop at workstation end of all Data/Voice drops.
    c. Provide 25-foot-long service loop at all camera drops.
    d. Provide 25-foot-long service loop at all WAP drops.
16. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions. The cable's minimum bend radius of 4 times the cable diameter and maximum pulling tension of 25 lbs shall not be exceeded.
17. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables.

C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 48inches apart. At no point shall cables rest on acoustic ceiling grids or tiles. All communications cable shall be supported from the building structure and bundled.
3. The cable support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.
4. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
5. Cables shall not be attached to ceiling grid or lighting support wires.
6. Where light support for drop cable legs is required, install clips to support the cabling.
7. Cables shall be installed above fire sprinkler piping and shall not be attached to the system or any ancillary equipment or hardware.
8. Cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

D. Cable in Conduit Installation:
1. Communications cables shall be run in conduits, where stubs are provided, from wall or floor jacks to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.

2. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569 for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
4. Do not route any data cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

3.4 WALL MOUNT FLAT SCREEN DISPLAY LOCATIONS

A. Provide a Category 6 non-keyed RJ-45 data jack on the wall as required and Category 6 cable to nearest MDF/IDF patch panel.

3.5 INTERIOR WIRELESS ACCESS POINT JACK LOCATIONS

A. Provide a surface mount housing “biscuit block” for two jacks with label window, blank module, Category 6 non-keyed RF-45 data jack, and Category 6 cable to nearest MDF/IDF patch panel.

B. For drop ceiling mounting locations, provide a surface mount housing to be mounted to a ceiling tile support bridge Atlas Sound model 81-4 or equivalent concealed above the finished ceiling.

C. For open structure mounting locations, provide a Wiremold/Legrand model WAPBRKT overhead device bracket with removable cover. The bracket shall be constructed of galvanized steel with a large capacity device compartment: 12-3/4" long x 9-1/2” wide x 3-1/8” deep. The bracket shall be securely attached to the overhead building structure by the included strap hardware or by an all thread rod.

D. Label the cable run designator(s) in a visible location on brackets/housings/enclosures and on the ceiling grid bar at jack locations that are concealed above a drop ceiling.

3.6 INTERIOR CAMERA JACK LOCATIONS

A. Provide a surface mount housing “biscuit block” for two jacks with label window, blank module, Category 6 non-keyed RJ-45 data jack, and Category 6 cable to nearest MDF/IDF patch panel.

B. For drop ceiling mounting locations, provide a surface mount housing to be mounted to a ceiling tile support bridge Atlas Sound model 81-4 or equivalent concealed above the finished ceiling.

C. For open structure mounting locations, provide a Wiremold/Legrand model WAPBRKT overhead device bracket with removable cover. The bracket shall be constructed of galvanized steel with a large capacity device compartment: 12-3/4" long x 9-1/2” wide x 3-1/8” deep. The bracket shall be securely attached to the overhead building structure by the included strap hardware or by an all thread rod.

3.7 EXTERIOR CAMERA JACK LOCATIONS

A. Provide a data jack surface mounted inside the building on the wall in a concealed and accessible location at least 12-inches above the finished ceiling. Surface mount housing shall be a “biscuit block” for two jacks with label window, blank module, Category 6 non-keyed RF-45 data jack, and Category 6 cable to nearest MDF/IDF patch panel.

B. Adjacent to jack provide a 3/4-inch rigid threaded conduit stub passing through the exterior wall with a temporary threaded pipe-cap exposed, making the stub ready to thread-in to the device weather proof backbox/enclosure.

3.8 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Firestopping."

B. Comply with requirements in Division 27 Section “Common Communications Requirements.”

C. Comply with TIA-569, Annex A, "Firestopping."

D. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.9 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607 and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.10 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606. Each patch panel jack, wall plate jack, terminal cabinet connector, and both ends of each cable run shall be labeled with a cable scheme run designator machine printed labels.

B. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

D. Cable and Wire Identification:
1. Cables shall be identified by a self-adhesive label.

2. Cable identifiers shall indicate the outlet room number and location as defined in section 27 10 00 Part 3.
3. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
4. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.
5. A cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the coverplate.
6. Cable labels shall not be obscured from view.
7. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

E. Outlet Plate Identification:
1. Outlet plates shall be labeled on the room side with TR patch panel ID corresponding to the source IT closet. Refer to section 27 10 00 Part 3 for definition of this ID.

F. Provide self-adhesive, color-coded, identification marker on ceiling grid directly below any device requiring an IP-connection above the ceiling. Ceiling marker to be Seton L12723 or equivalent. Division 27 related devices should utilize a yellow identification marker on the ceiling grid.

G. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.
2. Labels shall be machine printed. Type shall be 3/16 inch in height.

H. All labeling shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

I. All labels shall incorporate room numbers from the final Owner’s room numbering scheme. Coordinate with Owner to obtain final room numbers prior to applying labels.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:
1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection. All UTP cabling shall be certified to meet and/or exceed the specifications as set forth for Category 6-CLASS E/D Permanent Link Testing. Testing shall meet TIA/EIA TSB-95 for Category 6.
   a. Test instruments shall meet or exceed applicable requirements in TIA-568.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Certifications shall include the following parameters for each pair of each cable installed:

a. Characteristic Impedance 100 Ohm +/- 15%.
b. Wire map (pin to pin connectivity).
c. Permanent Link, station cable from patch panel to jack, should not exceed 295 feet (Channel length not to exceed 328 feet).
d. Detect split pairs and number of pairs present, 4 pairs required.
e. Attenuation <21.3 dB @ 100 MHz, < 35.9 dB @ 250 MHz.
f. Return Loss < 26.8 dB @ 100 MHz, < 20.5 dB @ 250 MHz.
g. NEXT > 39.9 dB @ 100 MHz, > 33.1 dB @ 250 MHz.
h. PS NEXT > 37.1 dB @ 100 MHz, > 30.2 dB @ 250 MHz.
i. ELFEXT > 23.3 dB @ 100 MHz, > 15.3 dB @ 250 MHz.
j. PS ELFEXT > 20.3 dB @ 100 MHz, > 12.3 dB @ 250 MHz.
k. ACR > 18.6 dB @ 100 MHz, > -2.8 dB @ 250 MHz.
l. PS ACR > 15.8 dB @ 100 MHz, > -5.7 dB @ 250 MHz.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.

G. Prepare test and inspection reports.

3.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer’s original, unopened, protective containers and packaging, with labels clearly identifying product name and manufacturer.
1. Store materials in secure, clean, and dry area indoors in accordance with manufacturer’s instructions.
2. Protect materials and finish from damage and moisture during handling and installation.

END OF SECTION

SECTION 27 30 14 - VOICE COMMUNICATION SYSTEM FOR ELEVATORS

PART 1 GENERAL

1.1 SUMMARY

A. For each elevator, provide VoIP-to-FXS gateway(s) to enable emergency communication from the elevator car(s) to an external location staffed by authorized personnel in accordance with ASME A17.1.

B. Related Requirements:
1. Drawings, including all Architectural, Structural, Mechanical, Electrical, Plumbing, Fire Protection, and/or Technology Plans referencing elevators.
2. Division 01 Specification Sections and general provisions of the Contract, including General and Supplementary Conditions.
3. Division 14 Section(s) for elevator specifications.
4. Division 27 Section "Communications Copper Horizontal Cabling" for data and telephone cabling.
5. Division 27 Section "Pathways for Communication Systems" for supports and/or raceways for cabling systems.

1.2 DEFINITIONS

A. ASME – American Society of Mechanical Engineers, the US standards body associated with the safety code for elevators and escalators.

B. FXO – Foreign Exchange Office analog telephone device jack

C. FXS – Foreign Exchange Subscriber analog telephone outlet

D. SIP – Session Initiation Protocol (as used in VoIP applications)

E. VoIP – Voice over Internet Protocol

1.3 REFERENCE STANDARDS

A. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include manufacturer’s warranty terms.

B. Shop Drawings:
1. Include plan(s) showing location(s) of equipment specified under this section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevator communication gateway device(s) to include in operation and maintenance manuals.

B. As-Built Plan(s) showing location of elevator communication system component(s) and approximate routing of system cabling.

1.6 WARRANTY

A. Warranty: Manufacturer(s) and Installer agree to repair or replace components of elevator communicator system that fail(s) in materials or workmanship within specified warranty period.
1. Warranty Period: Not less than one year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Analog Telephone Cable: Provide unshielded twisted pair copper horizontal cabling from communicator location to elevator controller in accordance with Division 27 section "Communications Copper Horizontal Cabling".

B. VoIP Cable: Provide patch cable and/or permanent link cabling from communicator location to network equipment as required for communicator operation. Cabling specification and labeling shall be in accordance with Division 27 section "Communications Copper Horizontal Cabling".

2.2 ELEVATOR CELLULAR COMMUNICATION SYSTEM

A. Elevator VoIP-to-FXS Gateway: Provide gateway device to connect from Owner’s VoIP telephone system to analog telephone FXS port. Gateway shall permit all communication protocols required by elevator to pass over Owner’s VoIP phone system. Coordinate elevator’s communication protocol requirements with elevator manufacturer.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Cisco ATA 180 series.
a. Others by Prior Written Approval.

B. Uninterruptible Power Supply (UPS): If required to meet code minimum talk time, provide battery backup UPS to supply power to system in the event of building power failure. Provide sufficient backup battery capacity to supply system for not less than four hours of talk time per code.
1. Basis-of-Design Product: Subject to compliance with requirements, provide APC #SC450RM1U or comparable product by one of the following:
a. Manufacturer of Gateway/Terminal equipment.
b. Eaton.
c. Tripp-Lite.
d. Vertiv.
e. Others by Prior Written Approval.

PART 3 EXECUTION

3.1 INSTALLATION

A. ASME A17.1: Comply with ASME A17.1 “Safety Code for Elevators and Escalators” for installation of Elevator Communicator.

1. System components requiring building power shall be connected to building emergency power and/or battery backup devices such that the system is capable of providing not less than four hours of talk time per A17.1:2.27.1.1.5.
2. Integrate with the elevator’s communications failure detection and/or annunciation such that loss of communication capability is detected and annunciated in accordance with A17.1:2.27.1.1.6.

B. Comply with NECA 1.

C. 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.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section 26 05 36 "Cable Trays for Electrical Systems."
3. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

A. Label elevator communication gateway with a printed label including the following information:

ELEVATOR COMMUNICATION GATEWAY
PHONE NUMBER: (xxx) xxx - xxxx
IP ADDRESS: xxx.xxx.xxx.xxx

B. Label cabling in accordance with Division 27 section “COMMUNICATIONS COPPER HORIZONTAL CABLING”.

3.3 FIELD QUALITY CONTROL

A. Prior to inspection of Elevator System by AHJ, perform the following tests and inspections in cooperation with elevator installer:
1. Verify communications gateway can successfully connect elevator phone to an outside source per code and local requirements.
2. Verify loss of communication is correctly annunciated per code and local requirements.

B. Elevator Communications System will be considered defective if it does not pass AHJ tests and inspections.

SECTION 27 41 16.00 - INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT - COMMON REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to all of the Contract Documents, including but not limited to the E- and T- series sheets, for installation locations and quantities of devices described herein.

1.2 SUMMARY

A. Section includes:
   1. Common requirements for audio-video systems as described in the corresponding sections and on drawings, including:
      a. Conference Room AV
      b. Large Group Instruction (LGI) AV

B. Reference Project drawings for particular locations, quantities, and coordination with other trades.

C. Related Requirements:
   1. Installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications
   2. Division 26 Section "Raceways and Boxes for Electrical Systems" for boxes and raceways.
   3. Division 27 Section “Grounding and Bonding for Communications Systems” for grounding and bonding requirements at head end equipment racks, frames, and enclosures.
   4. Division 27 Section “Audio-Video Cabling and Accessories” for system cabling and accessories and related procedures and standards.

1.3 DEFINITIONS

A. Acronyms and Abbreviations
   1. ALS - Assistive Listening System
   2. AWG - American Wire Gauge
   3. HDMI - High-Definition Multimedia Interface standard
   4. HDBaseT - Standard for distributing high-definition video and audio signals over standard twisted pair cabling
   5. IR - Infrared
   6. PC - Personal Computer
   7. RF - Radio frequency
   8. RS-232 - Serial data interface per TIA-232
   9. RS-422 - Serial data interface per TIA/EIA-422
   10. RS-485 - Serial data interface per TIA/EIA-485
   11. TD - Teaching Display
   12. TS - Teacher Desk Station
   13. USB - Universal Serial Bus cable and connector standard

B. Major System Components include but are not limited to the items described as such in the Part 2 article names, including:
   1. Display(s),
   2. Loudspeaker(s),
   3. Amplifier(s),
   4. Signal switching and processing equipment,
   5. Signal source equipment including media player(s), microphone(s), and camera(s),
   6. Powered signal extender(s),
   7. RF Transmitting and Receiving equipment and Antenna(s)
   8. Control system processor(s) and interface(s)

1.4 PREINSTALLATION MEETINGS

A. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work. Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 27 Section "Communications Shop Drawings and Submittals" for products specified under PART 2 - PRODUCTS.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 27 Section "Communications Shop Drawings and Submittals".

C. Product Data as follows:
   1. Bill-of-materials with part number listing of all system components, cabling, and accessories
   2. Datasheets for each type of cabling to be provided
   3. Short-form datasheets (not full user manuals—please save those for the O&M manual!) providing part numbers and basic physical and performance specifications of each Major System Component (as defined above)
   4. Datasheets for mounting hardware including load capacities

D. Shop Drawings:
   1. Floor plans and/or reflected ceiling plans showing the physical locations of devices for each system.
   2. Diagrams for power, signal, and control wiring for each type of system
   3. Rack elevations

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installer/integrator, qualified layout technician, installation supervisor, and field inspector.

1.7 CLOSEOUT SUBMITTALS

A. Hardware Operational Documentation:
   1. User manuals, preferably in electronic form, for each Major System Component (as defined in 1.5(B) above).

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On compact disk or USB flash drive, complete with data files.

3. Device address list.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be allowed for any portion of the audio-video scope of work.
   2. The projector system installer shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of five (5) projects of comparable size or larger and contact names confirming successful completion.
   3. The bidder shall have an authorized service center within 75 miles of the project's location for the brand of equipment that is submitted for bid. The Owner reserves the right to perform an onsite inspection.
   4. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.

B. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. NFPA 70 – National Electrical Code.
   2. Local Codes and Amendments.

C. Other References:
   1. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
   2. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
   3. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of AV system(s) that fail in materials or workmanship within one year, or period specified in products section.

B. Special Warranty: Installer agrees to repair AV System(s) and/or replace components, cabling, etc. that fail in materials or workmanship within specified warranty period.
   1. Special Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.1 GENERAL

A. Incidental and Miscellaneous Appurtenances: Contractor shall include in his bid and provide all incidental and/or miscellaneous appurtenances, including but not limited to power supplies, expansion cards, brackets, etc. as required for a complete and operational system with all functionalities specified herein, whether or not such appurtenances are identified herein.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.

C. All products shall be new and brought to the job site in the original manufacturer's packaging.

D. Electrical components (including innerduct) shall bear NRTL and FCC listings as required by applicable law.

2.2 CONFERENCE ROOM AV

A. Refer to section 274116.23 for products and procedures specific to this scope.

2.3 LGI AV

A. Refer to section 274116.50 for products and procedures specific to this scope.

2.4 ACCESSORIES

A. I/O Plates: Provide Input/Output Plates per the basis of design indicated on drawings. Subject to requirements, provide plates by Penn Elcom, RDL, Whirlwind, or approved equals.

B. Connectors: Provide connectors at Input/Output Plates per the basis of design indicated on drawings. Subject to requirements, provide connectors by Leviton, Neutrik, or approved equals.

PART 3 EXECUTION

3.1 PREPARATION

A. Furnish in a timely fashion all floor boxes, back boxes, and other specialty enclosures and appurtenances which are to be installed by other trades.

3.2 GENERAL EQUIPMENT INSTALLATION

A. Comply with NECA 1.

B. Furnish cabling, plates, and labor necessary for the complete installation of the AV System architectural infrastructure, in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

C. Refer to division 27 section AUDIO-VIDEO CABLING AND ACCESSORIES for detailed requirements and standards applicable to cabling.

D. Equipment shall be fixed firmly in place with proper types of mounting hardware. Equipment affixed to the building structure shall be self-supporting with a safety factor not less than three U.O.N.

3.3 SEQUENCED RACK POWER CONNECTIONS

A. Connect the following equipment to constant (non-sequenced) power: Network Switches, Rack Lighting, Control System Processors & Interfaces

B. Connect equipment to power sequencer steps as follows:
1. Audio DSPs, Video Switchers, and Processors (where applicable)
2. Powered extenders, Wireless Microphones, Media Players, Assistive Listening
3. Power Amplifiers, Powered Loudspeakers

C. Exact sequence may vary according to equipment requirements, but in general, amplifiers should turn on last and turn off first to avoid speaker damage from switching transients

3.4 IDENTIFICATION

A. Label each cable at both ends using machine-printed adhesive or heat shrink labels.

B. Labels shall include identifying information corresponding to cabling diagram provided in shop drawing and Operator Manual submittals.

3.5 ADJUSTING

A. 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.

3.6 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for not less than two years.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units. Separate training shall be provided for each type of system installed.

END OF SECTION

SECTION 27 41 16.55 - INTEGRATED AUDIO-VIDEO SYSTEMS - DINING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Provide complete instructional audio-video systems as described herein and on drawings, including:
      a. Ceiling-mounted projector display systems
      b. Display mount(s)
      c. Local sound system.
      d. Cabling and plates.
      e. Other infrastructure appurtenant to the above.

B. Reference Project drawings for locations, quantities, and coordination with other trades.

C. Related Requirements:
   1. Division 27 Section "Integrated Audio-Video Systems and Equipment - Common Requirements for common requirement applicable to all AV systems.
   2. Division 27 Section “Audio-Video Cabling and Accessories” for system cabling and accessories and related procedures and standards.

PART 2 PRODUCTS

2.1 MAJOR SYSTEM COMPONENTS: DISPLAYS

A. Projector: (VP)
   1. Epson EB-PU2113W Projector:
      a. 13,000 lumen WUXGA (1920x1200) video projector.
      b. 20,000 hour laser-phosphor light source.
      c. Integral HDBaseT receiver.
   2. Front Projection Screen:
      a. Tab-tensioned motorized projection screen.
      b. Matte white fabric.
      c. 87" H, 139" W viewable area (16:10 aspect ratio).
   3. Products:
      a. Projector: Provide Epson #EB-PU1333W or Engineer approved equal.
      b. Mount: Provide Chief #VCTUW, column, and structure mounts.
      c. Screen (VS): Provide Da-Lite #34558L or Engineer approved equal.

2.2 MAJOR SYSTEM COMPONENTS: AUDIO PROCESSING AND AMPLIFICATION

A. Digital Signal Processor: (DSP-D)
   1. DSP shall facilitate mixing and routing of audio
   2. DSP shall include ethernet and USB port for control and interface to PC and mobile devices.
   3. Basis-of-Design Product: Subject to compliance with requirements, provide Yamaha #TF-Rack. Substitutions by written Owner approval only.
   4. Provide DSP with Dante expansion interface card. Yamaha #NY64-D or Engineer-approved equal.

B. Audio Power Amplifier: (AMP-D1)

1. Amp shall provide two channels of amplification for low-impedance speaker zones
2. Power rating: 600W per channel for 4Ω and 8Ω loads.
3. Amp shall include auxiliary contacts for power-down on fire alarm.
4. Basis-of-Design Product: Subject to compliance with requirements, provide Crown #DCi 2|600 or comparable product by one of the following:
   a. Ashly
   b. Electro-Voice
   c. Lab Gruppen
   d. Others by Engineer approval.

C. Audio Power Amplifier: (AMP-D2)
1. Amp shall provide two channels of amplification for low-impedance speaker zones
2. Power rating: 300W per channel for 4Ω and 8Ω loads.
3. Amp shall include auxiliary contacts for power-down on fire alarm.
4. Basis-of-Design Product: Subject to compliance with requirements, provide Crown #DCi 2|300 or comparable product by one of the following:
   a. Ashly
   b. Electro-Voice
   c. Lab Gruppen
   d. Others by Engineer approval.

D. Loudspeakers (DS)
1. Yoke-mounted point-source loudspeaker with 12” cone LF, horn loaded HF w/ 120x60 coverage pattern.
2. Power Rating: 600W Long-Term, 2400W peak.
3. Sensitivity: Min. 98 dB_{SPL} 1W @ 1m.
4. Nominal impedance: 8Ω.
5. Basis-of-Design Product: Subject to compliance with requirements, provide Electro-Voice #EVF-1122S 126 or comparable product by one of the following:
   a. Biamp
   b. D&B Audiotechnik
   c. JBL
   d. Others by Engineer approval.

2.3 MAJOR SYSTEM COMPONENTS: RF TRANSMITTERS, RECEIVERS, AND ANTENNAS

A. Wireless Microphone System: (WMRX-D1, -D2, -D3)
1. Provide UHF Digital wireless microphone transmitter/receiver pair.
2. Transmitter shall be handheld type.
3. Provide rechargeable battery and charging dock with sufficient spaces for total number of systems supplied..
4. Basis-of-Design Product: Subject to compliance with requirements, provide (3) #QLXD24/SM58 (handheld kits), or Engineer-approved equal.

B. Wireless Microphone Antenna D

C. Wireless Microphone Architectural Remote Antenna: (above AVR1)
1. Provide dual-feed Architectural diversity antenna for UHF wireless microphones.
2. Color of antenna to be white
3. Basis-of-Design Product: Subject to compliance with requirements, provide RFVenue #D-ARC

D. Assistive Listening: (ADA-TX-D)
1. Unit shall provide compliant assistive listening service for accessibility via FM beltpack packaged with unit.

2. Basis-of-Design Product: Subject to compliance with requirements, provide Williams #FM ADA KIT 1 or approved equal.

2.4 MAJOR SYSTEM COMPONENTS: HDBASET & AV-OVER-IP SIGNAL EXTENDERS

A. HDBaseT Transmitter, Wall Plate Type: (HDBT-TX)
1. Transmitter device shall permit HDCP-compliant transport of 4k60, 4:2:0 HDMI video from input location to destination over twisted pair cabling.
2. Device shall be US 1-gang wall plate form factor.
3. Devices shall receive power via HDBaseT output.
4. Basis-of-Design Product: Subject to compliance with requirements, provide Kramer #WP-789T or comparable product by one of the following:
   a. Aten
   b. Atlona
   c. Crestron
   d. Extron
   e. Liberty AV

B. HDBaseT Reciever, Box Type (HDBT-RX):
1. Receiver device shall permit HDCP-compliant transport of 4k60, 4:2:0 HDMI video from input location over twisted pair cabling.
2. Receiver shall be capable of either receiving power or accepting power via HDBaseT input.
3. Receivers shall provide IR and RS-232 control outputs for display control.
4. Basis-of-Design Product: Subject to compliance with requirements, provide Kramer #TP-789R or comparable product by one of the following:
   a. Aten
   b. Atlona
   c. Crestron
   d. Extron
   e. Liberty AV

C. HDBaseT Video Switcher & De-multiplexer:
1. Switcher/demux shall provide HDMI inputs at rack for Owner use and demultiplex audio from HDMI input for routing through local sound system.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Kramer #VP-440H2. or comparable product by one of the following:
   a. Aten
   b. Atlona
   c. Crestron
   d. Extron
   e. Liberty AV

2.5 MAJOR SYSTEM COMPONENTS: SIGNAL SOURCES

A. Bluetooth Receiver: (BTRX-D).
1. Receiver shall permit audio input from mobile devices via Bluetooth and shall output balanced audio to DSP.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Denon #DN-200BR or comparable product by one of the following:
   a. Galaxy Audio
   b. Radial

2.6 MAJOR SYSTEM COMPONENTS: ENCLOSURE & POWER SUPPLY EQUIPMENT

A. Open Frame AV Rack: (AVR1)
   1. Provide wall-mounted open frame rack for support of equipment.
   2. Rack to be welded steel construction with black powdercoat finish.
   3. Rails to be drilled on standard EIA spacing, tapped 10-32.
   4. Dimensions:
      a. Capacity: 20 RU.
      b. Overall depth: 24".
   5. Basis-of-Design Product: Subject to compliance with requirements, provide nVent Hoffman Versarack #E19SWM20U24 or comparable product by:
      a. Chatsworth
      b. Others by Engineer Approval.

B. Power Sequencer: (mounted inside AVR-D)
   1. Provide 3-stage 120V, 15-amp power sequencer with surge protection.
   2. Basis-of-Design Product: Subject to compliance with requirements, provide AtlasIED ECS-3 or comparable product by Engineer approval.

2.7 ACCESSORIES

A. I/O Plates: Provide Input/Output Plates per the basis of design indicated on drawings. Subject to requirements, provide plates by Penn Elcom, RDL, Whirlwind, or approved equals.

B. Connectors: Provide connectors at Input/Output Plates per the basis of design indicated on drawings. Subject to requirements, provide connectors by Leviton, Neutrik, or approved equals.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL & SYSTEM STARTUP

A. Startup Service.
   1. Connect power as described above.
   2. Complete equipment installation and startup checks according to manufacturer's written instructions.
   3. Set up peak limiters on each DSP output to amplifiers for loudspeaker protection.
   4. Set coordinated radio channels on wireless microphone systems, etc. per manufacturer's instructions.
   5. Verify interactive display onboard PC functions correctly.
   6. Verify each wired AV and USB signal path passes signal.
   7. Set equalization curves and delays on loudspeakers as needed to deliver clear intelligible audio to occupants.
   8. Update firmware and software on all installed equipment to latest available version

B. Prepare test and inspection reports.

END OF SECTION

SECTION 27 41 16.56 - INTEGRATED AUDIO-VIDEO SYSTEMS - GYMNASIUM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Provide complete instructional audio-video systems as described herein and on drawings, including:
      a. Local sound system.
      b. Cabling and plates.
      c. Other infrastructure appurtenant to the above.

B. Reference Project drawings for locations, quantities, and coordination with other trades.

C. Related Requirements:
   1. Division 27 Section "Integrated Audio-Video Systems and Equipment - Common Requirements for common requirement applicable to all AV systems.
   2. Division 27 Section “Audio-Video Cabling and Accessories” for system cabling and accessories and related procedures and standards.

PART 2 PRODUCTS

2.1 MAJOR SYSTEM COMPONENTS: AUDIO PROCESSING AND AMPLIFICATION

A. Digital Signal Processor: (DSP-G)
   1. DSP shall facilitate mixing and routing of audio
   2. DSP shall include ethernet and USB port for control and interface to PC and mobile devices.
   3. Basis-of-Design Product: Subject to compliance with requirements, provide Yamaha #TF-Rack. Substitutions by written Owner approval only.

B. Audio Power Amplifier: (AMP-G)
   1. Amp shall provide two channels of amplification for low-impedance speaker zones
   2. Power rating: 150W per channel for 4-ohm loads.
   3. Amp shall be fanless architecture.
   4. Amp shall include auxiliary contacts for power-down on fire alarm.
   5. Basis-of-Design Product: Subject to compliance with requirements, provide Crown DCi 2|600 or comparable product by one of the following:
      a. Crown
      b. Electro-Voice
      c. Lab Gruppen
      d. Others by Engineer approval.

C. Loudspeakers (GS)
   1. Yoke-mounted point-source loudspeaker with 12” cone LF, horn loaded HF w/ 120x60 coverage pattern.
   2. Power Rating: 600W Long-Term, 2400W peak.
   3. Sensitivity: Min. 98 dB_{SPL} 1W @ 1m.
   4. Nominal impedance: 8Ω.
   5. Basis-of-Design Product: Subject to compliance with requirements, provide Electro-Voice #EVF-1122S 126 or comparable product by one of the following:
      a. Biamp

b. D&B Audiotechnik
c. JBL
d. Others by Engineer approval.

2.2 MAJOR SYSTEM COMPONENTS: RF TRANSMITTERS, RECEIVERS, AND ANTENNAS

A. Wireless Microphone System: (WMRX-G)
1. Provide UHF Digital wireless microphone transmitter/receiver pair
2. Provide rechargeable battery and charging dock.
3. Gym shall have one beltpack transmitter with headworn microphone.
4. Basis-of-Design Product: Subject to compliance with requirements, provide (1) #SLXD14/153T (beltpack & headworn mic kit), or comparable product by one of the following:
a. Sennheiser EW-D Series

B. Wireless Microphone Architectural Remote Antenna: (above TDG)
1. Provide dual-feed Architectural diversity antenna for UHF wireless microphones.
2. Color of antenna to be white
3. Basis-of-Design Product: Subject to compliance with requirements, provide RFVenue #D-ARC

C. Assistive Listening: (TAS-TX)
1. Unit shall provide compliant assistive listening service for accessibility via FM beltpack packaged with unit.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Williams #FM ADA KIT 1 or approved equal.

2.3 MAJOR SYSTEM COMPONENTS: SIGNAL SOURCES

A. Bluetooth Receiver: (BTRX-G).
1. Receiver shall permit audio input from mobile devices via Bluetooth and shall output balanced audio to DSP.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Denon #DN-200BR or comparable product by one of the following:
a. Galaxy Audio
b. Radial

2.4 MAJOR SYSTEM COMPONENTS: ENCLOSURE & POWER SUPPLY EQUIPMENT

A. Open Frame AV Rack: (AVR2)
1. Provide wall-mounted open frame rack for support of equipment.
2. Rack to be welded steel construction with black powdercoat finish.
3. Rails to be drilled on standard EIA spacing, tapped 10-32.
4. Dimensions:
a. Capacity: 12 RU.
b. Overall depth: 24".
5. Basis-of-Design Product: Subject to compliance with requirements, provide nVent Hoffman Versarack #E19SWM12U24 or comparable product by:
a. Chatsworth
b. Others by Engineer Approval.

B. Power Sequencer: (mounted inside AVR2)
1. Provide 3-stage 120V, 15-amp power sequencer with surge protection.
2. Basis-of-Design Product: Subject to compliance with requirements, provide AtlasIED ECS-3 or comparable product by Engineer approval.

2.5 ACCESSORIES

A. I/O Plates: Provide Input/Output Plates per the basis of design indicated on drawings. Subject to requirements, provide plates by Penn Elcom, RDL, Whirlwind, or approved equals.
   1. Audio input plates for display: Provide wall plate with 3.5mm and RCA unbalanced stereo audio input jacks on face and balanced mono output to sound system on back. Subject to requirements, provide RDL #D-CIJ3 or equal.

B. Connectors: Provide connectors at Input/Output Plates per the basis of design indicated on drawings. Subject to requirements, provide connectors by Leviton, Neutrik, or approved equals.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL & SYSTEM STARTUP

A. Startup Service.
   1. Connect power as described above.
   2. Complete equipment installation and startup checks according to manufacturer's written instructions.
   3. Set up peak limiters on each DSP output to amplifiers for loudspeaker protection.
   4. Set coordinated radio channels on wireless microphone systems, etc. per manufacturer's instructions.
   5. Verify interactive display onboard PC functions correctly.
   6. Verify each wired AV and USB signal path passes signal.
   7. Set equalization curves and delays on loudspeakers as needed to deliver clear intelligible audio to occupants.
   8. Update firmware and software on all installed equipment to latest available version

B. Prepare test and inspection reports.

END OF SECTION

SECTION 27 41 23 - AUDIO-VIDEO CABLING AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for cabling and accessories for audio-video systems.

B. Related Requirements:
1. Installation shall comply with all applicable codes and standards in effect at the job site and as indicated in the Drawings and Specifications
2. Division 27 Section “Pathways for Communication Systems” for pathways and support for system cabling.

1.2 DEFINITIONS

A. Acronyms and Abbreviations
1. ALS - Assistive Listening System
2. AWG - American Wire Gauge
3. Cat6 - Category 6 cable as defined in ANSI/TIA 568
4. Cat6A - Category 6A cable as defined in ANSI/TIA 568
5. F/UTP - Twisted-pair cabling with overall foil shield, without shielding of individual pairs within the cable.
6. HDMI - High-Definition Multimedia Interface standard
7. HDBaseT - Standard for distributing high-definition video and audio signals over standard twisted pair cabling
8. RF - Radio frequency
9. USB - Universal Serial Bus cable and connector standard
10. UTP - Twisted-pair cabling without overall shield

1.3 ACTION SUBMITTALS

A. Product Data:
1. Cabling product data shall be included in product data submittals for systems referencing this section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: All cabling for a given AV system (except data network drops provided by the structured cabling contractor) shall be provided by the same company providing the equipment for that AV system.

B. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. NFPA 70 – National Electrical Code.
2. Local Codes and Amendments.
3. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard.
4. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
5. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.

7. ISO/IEC 1180 Generic Cabling Standard.
8. EN 50173 Generic Cabling Standards for Customer Premises.

PART 2 PRODUCTS

2.1 GENERAL

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows unless noted otherwise:
   1. Indoor Cable: CL2P, CL3P, or CMP Plenum Rated Communications Cable
   2. Outdoor Cable: CL2, CL3, CM UV & Water Resistant, and/or Indoor/Outdoor Plenum OSP Communications Cable

C. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved assembly.

2.2 WIRE AND CABLE

A. Constant Voltage (70.7V) Loudspeaker Cable for Distributed Loudspeaker Systems: 2-Conductor Unshielded, 14 AWG minimum, bare conductors, rated CMP (plenum). Belden 6100UE or equal.

B. Mic/Line Level Analog Audio Cable: Individually shielded & twisted pairs (count as required for application), 22AWG tinned stranded conductors, rated CMP (plenum). Belden 9451 Series or equal.

C. HDBaseT and/or Video-Over-IP Cabling: Cat 6 UTP (unless otherwise noted), rated CMP (plenum). Refer to Section 27 06 10 Voice Data System. Provide typical Category 6 RJ-45 plug termination on both ends of cable in lieu of keystone jack terminations.

D. Point-to-point HDMI Cabling, non-plenum, 25 ft (7.6 m) or less: Provide high quality cable rated for in-wall installation and HDMI 2.0 minimum. C2G #2968x or equal.

E. Point-to-point HDMI Cabling, plenum, 25 ft (7.6 m) or less: Provide high quality cable rated for plenum installation and HDMI 2.0 minimum. C2G #4252x or equal.

F. Point-to-point HDMI Cabling, plenum, greater than 25 ft (7.6 m): Provide high quality active HDMI cable rated for plenum installation and 4k60Hz minimum: C2G #4145x or equal.

G. Wireless Microphone Antenna Cabling: Provide low-loss, plenum rated 50-ohm RG8 Coaxial Cable with 10AWG solid bare copper conductor. Belden 89913 or equal with Amphenol Connex 112563 or equal connector.

H. Assistive Listening System Antenna Cabling: Provide 75-ohm coaxial cable with 20AWG solid bare copper conductor. Belden 1370P or equal, with connectors as specified by manufacturer.

I. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.

J. Capacities and Characteristics:
1. All wire and cables shall be new and unused.
2. Indoor Wire which is not portable and is not installed within equipment racks or conduit shall be plenum-rated and meet all applicable codes

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for A/V system(s) to verify pathways and/or conduits are prepared and free of sharp edges and other conditions that may damage cable prior to cabling installation.

B. Inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate potential problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

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

3.2 GENERAL CABLING INSTALLATION

A. Comply with NECA 1.

B. Furnish cabling, plates, and labor necessary for the complete installation of the AV System(s) infrastructure, in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

C. 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.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for cable trays specified in Section 26 05 36 "Cable Trays for Electrical Systems."
3. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

D. Install cables parallel and perpendicular to building lines where possible.

E. Support cables in accordance with Division 27 Specification Section “Pathways for Communication systems”. Cables shall not be supported by ceilings, ductwork, piping, etc.

F. Cables shall be installed and routed in such a manner that they do not interfere with the operation of equipment or removal of ceiling tiles.

G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

H. Testing: Contractor shall test all installed cabling shall be tested after installation and prior to owner acceptance to confirm cabling and terminations are good and passing signals as intended. Re-terminate or replace cabling which does not pass testing.

3.3 CABLE PULLING

A. Follow manufacturers' recommendations for regulating temperature conditions of conductors prior to installation.

B. Exercise care in handling and installing cables to avoid damage. Carefully form cables in pull boxes, enclosures, etc. Form bends in cables larger than the minimum radii shown in the cable manufacturer's published data for minimum bends such that bends will not reduce the cable life.

C. Provide suitable installation equipment to prevent abrasion and cutting of conductors by raceways during the pulling of conductors.

D. The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.

E. Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment to ensure compliance.

F. Before any wire is pulled into any conduit, thoroughly swab the conduit to remove all foreign material and to permit the wire itself to be pulled into a clean, dry conduit.

G. Use manufacturer-approved pulling compound or lubricant where necessary, of non-conducting type. Compounds used must not deteriorate the conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

3.4 IDENTIFICATION AND LABELING

A. Color-code cables according to Division 27 Section "Common Communications Requirements."

B. Provide self-adhesive vinyl or vinyl-cloth wraparound tape machine printed marker labels, at both ends of each cable. Utilize systematic alphanumeric designations to identify cables for easy troubleshooting. Document cable labeling in O&M manual.

END OF SECTION

SECTION 27 51 23 - INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install a complete new intercommunication and program system for the facility as necessary.

B. Section Includes:
1. Intercom head-end equipment.
2. Intercom speakers and user interface devices.

C. Intercom cable.

D. Accessories.

E. RELATED REQUIREMENTS
1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.
2. Division 27 Sections pertaining to Audio Visual Systems for interface with local sound reinforcement systems.
3. Division 28 Section “Access Control Software and Database Management” for interface with emergency lockdown sequences.
4. Division 28 Section "Digital Addressable Voice Evacuation Fire Alarm System" for interface with fire alarm system.

1.2 DEFINITIONS

A. DHCP: Dynamic Host Configuration Protocol.

B. FXO: Foreign eXchange Office, the device-side port for analog telephone service.

C. FXS: Foreign eXchange Subscriber, the wallplate-side port for analog telephone service.

D. H.323: Audio and Video Protocol.

E. Paging: Communication via audio messages relayed by a distributed speaker system.
1. "One-Way", "Broadcast", or "Public Address" Paging: Audio message playback to one or more distributed locations or zones, without a means for the message source to hear return communication from the zones addressed. Message content may incorporate a live audio feed from a microphone or telephone interface, and/or playback of pre-recorded audio messages or program material.
2. "Two-Way" Paging: Live, bi-directional audio communication between a central administrative location and a remote location such as a classroom. 2-way communication may be initiated from either endpoint or by other means including sensors and automations.

F. SIP: Session Initiation Protocol, a standard protocol used in voice-over-IP telephone systems.

1.3 ACTION SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 and Division 27 Section “Communications Shop Drawings and Submittals” for products specified under PART 2 - PRODUCTS.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 27 Section “Communications Shop Drawings and Submittals”.

C. Product Data:
1. Complete system Bill-of-Materials.
2. Brief specification documents ("cut sheets") for each type of product.

D. Shop Drawings:
1. Complete floor plan drawings locating all system devices, including proposed routing of speaker lines.
2. Calculations indicating total length, total power, and selected wire size for each run of speaker wiring.
3. Overall system one-line diagram.
4. Wiring and interconnection schematics.
5. Detailed system operational description.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data for Installer. Refer to "Quality Assurance" article for qualification requirements.

1.5 CLOSEOUT SUBMITTALS

A. Start-up Testing Documentation: When requesting Owner Acceptance Testing, submit the following documentation from the Start-up Testing procedure:
1. A record of speaker line ground resistance and impedance testing.
2. A record of measured sound levels in designated spaces.

B. Operation and Maintenance Manual: Collect the information in an organized format including tabs and/or PDF bookmarks delineating each of the required sections below:
1. Project Record Documents, including:
a. Plans showing location of intercom system components, including head-end equipment, speakers, and user interface devices.
b. Record of speaker tap settings.
c. Device address list, where applicable.
2. Operation and Maintenance Documentation, including:
a. Hardware and Software operating manuals.
b. Maintenance parts list
c. Parts supplier contact information.
3. Warranty Documentation, including:
a. A copy of the manufacturers' standard statement(s) of warranty for all system components.
b. Installing contractor's statement of warranty on overall system and workmanship.
c. Warranty service contact information.

C. Program Software Backup: On USB media, complete with data files.

D. System Training Materials as described in Part 3.

1.6 QUALITY ASSURANCE

A. Installing Contractor Qualifications:
1. Contractor shall be an established electronic communication systems installer with minimum three years documented experience installing similar systems.
2. Contractor shall be an authorized distributor in good standing for the equipment supplied, with full manufacturer's warranty privileges.

B. Installing Personnel Qualifications:
1. Technicians performing work shall be trained in the basic principles and practices of distributed audio systems installation and integration.
2. Work shall be supervised by a technician trained and certified by the manufacturer to install the equipment specified.

1.7 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the communication system with all other trades.

B. Pre-installation Meeting: Schedule a pre-installation meeting specifically for the Intercommunications and Program System with Owner and Architect.

1.8 WARRANTY

A. Manufacturer shall warranty components of the installed system against defects in material and workmanship for a period of not less than five (5) years from the date of installation.

B. Installing contractor shall warranty workmanship and system integration for a period of not less than one (1) year after final acceptance of the Work by the Owner.

C. Defects occurring in labor or materials within the one-year warranty are to be rectified by replacement or repair. Correct detects in material or workmanship with a minimum loss of operating time at no cost to Owner.

D. Onsite Service: This Contractor, within the warranty period, is required to answer all service calls and requests for information within a 24-hour period and repair or replace any faulty item within a 24-hour period, without charge, including parts and labor.

PART 2 PRODUCTS

2.1 INTERCOM SYSTEM GENERAL REQUIREMENTS

A. System Features - Provide System with the following minimum characteristics and features:
1. System Topology: One-way communication to locations/zones indicated on drawings.
2. System Head End Devices:
a. One administrative master station at _____.
3. Paging speaker circuits to operate at 25 Volts.
4. Connection to Owner's internal phone exchange and the public telephone system via SIP trunk.

B. Zoning: Speaker lines shall be separated into zones according to the following schema:
1. Offices & Administrative Area Speakers
2. Level 1 Common Areas & Corridors
3. Level 1 Classrooms & Library

4. Level 2 Common Areas & Corridors
5. Level 2 Classrooms
6. Gym Area
7. Cafeteria / Dining Area
8. Kitchen / Food Prep Areas
9. Exterior Speakers
   Verify zoning with Owner prior to set up.

C. Sequences of Operation:
   1. Paging from Master / Admin Keyphone: Master selects any or all paging zones by entering the number associated with the desired zone or all-call. Audio is broadcast from master to all speakers in the selected zone(s).
   2. Paging from Telephone: Caller connects to telephone interface by dialing extension number assigned to paging system by Owner. Telephone interface prompts incoming caller to input a passcode to verify authorization. After passcode is successfully entered, caller is prompted to select any or all paging zones by entering the number associated with the desired zone or all-call. Audio is broadcast from the caller's telephone to all speakers in the selected zone(s).
   3. Bells & Program Playback: System receives incoming audio stream from district server via RTP and/or SRTP multicast stream received by Owner's streaming device ("the Barix"). Audio is played back on all speaker zones.
   4. Kitchen Night Ringer: When kitchen phone is placed in night ringer mode, incoming calls to the kitchen office ring over the kitchen & dining speaker zones.

2.2 COMPONENTS

A. Intercom Control Unit: Rack-mounted intercom control unit.
   1. Control Unit Nominal Size: Four (4) RU.
   2. Unit shall be of modular construction, allowing expansion by addition of modules.
   3. Unit shall provide up to nine (9) individual zones of paging.
   4. Unit shall accept control from master station via analog telephone line or page port.
   5. Basis-of-Design Product: Subject to requirements, provide a Bogen PCM2000 series control unit with the following modules and accessories:
      a. One (1) Bogen #PCMCPU Main CPU unit.
      b. One (1) Bogen #PCMTIM Paging telephone interface module.
      c. Three (3) Bogen #PCMZPM Three-zone distribution module. (9 total zones)
      d. One (1) Bogen PCMPS2 $12V_{DC}$ 1.5A power supply.
      e. One (1) Bogen RPK88 Rack mount bracket for PCM2000.

B. Keyphone Intercom Unit(s): Desk-mounted unit.
   1. Handset: Standard molded plastic telephone handset with permanently coiled cord.
   2. One-button dialing of most commonly dialed number or numbers.
   3. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.
   4. Complete station assignment including class of service, speed call numbers, and any other features assigned without any wiring changes being required.
   5. Facilities to permit the distribution throughout the facility of emergency announcements, all-page announcements, zone-page announcements and emergency/evacuation alert if authorized through class of service.
   6. Keyphone shall be located in administrative office. Phone shall be used for public and inter-school communication.

2.3 SPEAKERS

A. Lay-in Tile Ceiling-Recessed Speakers:

1. Provide 1'x2' nominal lay-in tile replacement recessed loudspeaker assemblies.
2. All speakers shall include 5 W integral transformer and front-mounted volume control.
3. Contractor may utilize RJ45 or 8P8C connectors and Category 5e or Category 6 cabling.
4. Finish color to be White unless noted otherwise.
5. Basis-of-design product: Subject to requirements, provide Quam #System 5VC or comparable product by manufacturers listed below.

B. Interior Ceiling-Recessed Speakers, other than lay-in tile:
1. Provide round, 12" diameter baffle recessed loudspeaker assemblies.
2. All speakers shall include 5W integral transformer and back can.
3. Provide speakers with appropriate mounting supports for application.
4. Finish color to be White unless noted otherwise.
5. Basis of design product: Subject to requirements, provide Quam #System 21 or #Solution 3, or comparable product by manufacturers listed below.

C. Interior Structure-Mount Speakers for areas with exposed structure:
1. Provide round, 12" diameter baffle recessed loudspeaker assemblies.
2. All speakers shall include 5 W integral transformer and back can.
3. Provide speakers with appropriate mounting supports for application.
4. Finish color to be White unless noted otherwise.
5. Basis-of-design product: Subject to requirements, provide Quam #BB2, or comparable product by manufacturers listed below.

D. Interior Wall-Recessed Speakers:
1. Provide square recessed backbox, with acoustic foam lining and conduit stub-up to nearby cabling pathway above accessible ceiling or bottom of structure. Coordinate backbox depths with other trades.
2. Provide 8" diameter speaker with 5 W integral transformer.
3. Provide 12" square baffle. Finish color to be White unless noted otherwise.
4. Basis-of-design product: Subject to requirements, provide Quam #8C10PAX/TBLU + #BS8W + #ES-8(-6), or comparable products by manufacturers listed below.

E. Interior/Exterior Wall-Recessed Vandal-Resistant Paging Horn:
1. Provide square recessed backbox, with acoustic foam lining and conduit stub-up to nearby cabling pathway above accessible ceiling or bottom of structure. Coordinate backbox depths with other trades.
2. Provide 16 W compression-type re-entrant horn loudspeaker with vandal-resistant square stainless steel baffle and integral transformer. Baffle finish to be White unless noted otherwise.
3. Basis-of-design product: Subject to requirements, provide Quam #H16/SVPS + #ES-8S, or comparable products by manufacturers listed below.

F. Exterior (Damp-location) Canopy Surface Mounted Vandal-Resistand Speaker:
1. Provide square surface-mount backbox with conduit connections and matching square vandal-resistant baffle with security torx fasteners. Finish color to be White unless noted otherwise.
2. Provide 8" diameter moisture-resistant loudspeaker with 5W integral transformer.
3. Basis-of-design product: Subject to requirements, provide Quam #System 1VP or comparable products by manufacturers listed below.

G. Manufacturers: Subject to requirements, comparable products by the following manufacturers are acceptable in lieu of the bases of design specified above:
1. AtlasIED
2. Lowell
3. Others by prior Engineer approval.

2.4 REMOTE VOLUME CONTROL DEVICES

A. Wall-Mounted Volume Control: 10-watt, stepped, recessed autotransformer volume control in US 1-gang form factor. Volume control shall have public address (PA) emergency override of volume control. Provide Atlas Sound #AT-10PA or Quam #QC-10P. Equivalents from all acceptable manufacturers to be accepted.

B. Remote Source Output Volume Control: Rack-mounted in remote source rack. Provide line level volume control.

2.5 UPS BATTERY BACK-UP

A. Acceptable Manufacturers: Liebert, Best Power, APC, TrippLite.

B. Provide UPS battery back-up for the communications system to operate a minimum of 24 hours standby then 20 minutes of operation upon loss of power.

2.6 CONDUCTORS AND CABLES

A. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper. Size conductors according to load and wire gauge per table included in part 3 of this section, not smaller than 18AWG.

B. Insulation: Thermoplastic, not less than 1/32 inch thick.

C. Plenum Cable: Listed and labeled for plenum installation.

2.7 RACEWAYS

A. Intercommunication and Program System Raceways and Boxes: Comply with requirements in Division 26 Section "Pathways for Communications Systems."

B. Flexible metal conduit is prohibited.

PART 3 EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and j-hooks 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.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for raceways and boxes specified in Division 27 Section "Pathways for Communications Systems."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. 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.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Installation of Raceways:
1. Comply with requirements in Division 26 Section "Pathways for Communications Systems" for installation of conduits and wireways.
2. Install manufactured conduit sweeps and long-radius elbows whenever possible.

C. Equipment Installation
1. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.
2. Provide and install an Administrative Control Station at the following locations:
   a. Reception Desk
   b. Principal’s Office.
3. General: Install new communication system components in accordance with the manufacturer’s instructions.
   a. Terminate all field wiring on rack mounted terminal blocks mounted in the head end equipment rack.
   b. Label cables and wiring logically, legibly, and permanently for ease of identification, using printed heat shrink labels.
   c. Provide integration of clock and bell and telephone system.
   d. Provide integration of local sound reinforcement system override.
   e. Provide integration of remote emergency pushbuttons.

D. Speaker Installation:
1. Install new speaker types as indicated on the Drawings.
2. All speakers shall be supported from building structure at at least two points. Supports shall be independent of the work of other trades.
3. Speaker wattages shall be initially set based on the speaker type, mounting height, and area served. In general:
   a. Lay-in Speakers:
      1) Classrooms: 1.25 Watt.
      2) Typical corridors and other low-volume spaces: 1.25 Watt.
      3) High-volume (Ceiling > 12' AFF, < 20' AFF) spaces: 2.5 Watts
      4) Extra-high-volume (Ceiling > 20' AFF): 5 Watts
   b. Hard Deck Speakers:
      1) Bathrooms, locker rooms, & other low-volume spaces: 1.25 Watt.
      2) High volume (Ceiling > 12' AFF) spaces: 2.5 Watt.
      3) Extra-high-volume (Ceiling > 20' AFF) spaces: 5 Watt.
   c. Exposed Structure Area Speakers: Maximum (U.O.N.)
   d. Interior Wall Recessed Speakers: 1.25 Watt (U.O.N.)
   e. Exterior Wall Recessed Speakers:
      1) Mounting Height ≥ 11’ AFF: 4 Watt
      2) Other locations: 2 Watt
   f. Exterior Canopy Mounted Speakers:
      1) Mounting Height ≥ 11' AFF: 2.5 Watt
      2) Other locations: 1.25 Watt
4. Speakers in high ambient noise areas (i.e. Dining, Gymnasiums, etc.) shall be tapped as required to overcome the ambient noise generated by the public.
5. Speakers equipped with integral volume controls shall have their volume control set to maximum.
6. Provide silicone sealant at all canopy penetrations at exterior canopies. At single-layer pre-fabricated metal canopy ("Avadeck" or similar), penetrate canopy only at upper flute.
7. Provide silicone sealant at top and sides of baffle at all exterior back box locations.

E. Cabling Installation:
1. Comply with NECA 1.
2. Return air plenum cable shall be used. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
3. Speaker conductor sizing: Speaker wiring topology and sizes shall be selected such that cabling losses do not exceed 0.5dB (11% power loss in W). Refer to table below for maximum allowable line length at various power levels and wire gauges:

	Total Load on Line							
Wire Gauge	**7.5W**	**15W**	**30W**	**60W**	**100W**	**125W**	**250W**	**400W**
10	2500'	1250'	625'	313'	188'	138'	69'	46'
12	1550'	775'	388'	194'	118'	94'	47'	29'
14	950'	475'	238'	119'	75'	56'	28'	18'
16	600'	300'	150'	75'	46'	36'	18'	11'
18	375'	188'	94'	47'	29'	23'	11'	N/A

4. 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.
5. 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.
6. 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.
7. Tag each circuit at each end and at each terminal with a separate tag indicating the area served.

F. Grounding
1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.3 SYSTEM START-UP AND INITIAL TESTING

A. Assemble and mount head end equipment per manufacturer instructions

B. Install and label all speaker zone cabling.

C. Prior to connecting speaker zone cabling to amplifiers: Using an audio impedance tester, measure impedance of each speaker zone to verify correct tap settings and detect wiring faults. Report test signal frequency and measured zone impedance / power draw on testing report.

D. Connect speaker zones to amplifier(s) per manufacturer's instructions.

E. Connect line level program source from owner's bell control system to paging system and coordinate with owner to configure system gain staging.

F. Program system telephone card to function with Owner's telephone system per owner preferences and manufacturer instructions.

G. Initial Testing and Adjustment: After connection to Owner's program source and telephone systems, test individual zone and all-call pages from each source. Adjust speaker volume controls, speaker tap settings, and gain staging to meet the following criteria
   1. Volume levels of program source, microphone(s), and paging from phones are balanced appropriately (e.g.: volume of bell tones should not be much louder or quieter than spoken paging messages).
   2. Sound produced by system is free from noise, distortion, and interference, including but not limited to perceptible 60-cycle hum at any location in the building.
   3. Overall volume levels in spaces are sufficiently loud to ensure paging message intelligibility, and not so loud as to cause occupant discomfort.

H. 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.

I. Prepare test and inspection reports.

3.4 ACCEPTANCE BY OWNER

A. Upon completion of initial tests and delivery of all documents, diagrams, and project record drawings, notify the Architect in writing that the installation has been completed in accordance with the requirements of the specification and is ready for equalization and inspection by representatives of the Owner.

B. Acceptance testing will include inspection and assessment of system completeness, including inspection of labeling and dressing of system cabling, by Engineer's representative.

C. Acceptance testing will include operation by the Owner of each major system and other components (i.e. microphones, consoles, racks, loudspeakers, etc.) deemed necessary. Contractor will assist as necessary in this testing.

D. In the event the need for further adjustments or work becomes evident during acceptance testing, the Contractor will continue his work until system is acceptable at no additional cost to the Owner.

E. Contractor shall provide a Final Acceptance Test record document signed by both the Contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.

F. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.5 DEMONSTRATION

A. Provide systems demonstration and instructions. Allow minimum of eight (8) hours - four (4) hours over each of two (2) days.

B. Conduct walking tour of Project and briefly describe function, operation, and maintenance of each component.

C. Use submitted operation and maintenance manual as reference during demonstration and training.

D. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received, and completed the training program.

3.6 POST-OCCUPANCY ADJUSTMENT

A. 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.

B. 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.

END OF SECTION

SECTION 28 00 00 - COMMON ELECTRONIC SAFETY AND SECURITY REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements contained in this Section apply to all Sections of this Division.

1.2 SUMMARY

A. This section includes general design requirements, administration topics, and installation for electronic safety and security systems.

B. Refer to section 28 05 10 - Scope of the Electronic Safety and Security Work for a description of project scope.

C. Section Includes:
1. Common terminology and requirements used throughout this Division.
2. Identification and labeling.
3. Firestop systems.
4. Sleeves for raceways and cables.
5. Grout.

1.3 STRUCTURED CABLING SYSTEM SCOPE OF WORK

A. Refer to Division 27 Sections for more information on the low-voltage structured cabling system infrastructure required for this project.

B. Cable infrastructure project requires a Leviton/Berk-Tek structured cable system backed by the manufacturer's system warranty as specified.

1.4 DEFINITIONS

AHJ: Authority(ies) Having Jurisdiction.

Architect: The Architect of Record for the project, if any.

Business Day: Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.

CFCI: Contractor Furnished, Contractor Installed

Contract Documents: All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to, plans, specifications, addenda, instructions to bidders (both General and Sub-Contractors), unit prices, change orders, architect’s supplemental instructions, etc.

Contractor: The General Contractor and/or Construction Manager, and any contractor or subcontractor performing any low-voltage communications work in the project, whether proposing/working independently or subcontracted under the.

Engineer: The Consulting Mechanical-Electrical Engineers either consulting to the Owner, Architect, other Engineers, etc.

Furnish: Deliver to the site in good condition.

Install: Install equipment furnished by others in complete working order.

(Installed) In EMT/IMC/RMC: Wire and/or cable so identified shall be installed enclosed in the specified type of electrical conduit, subject to the requirements of applicable article(s) of NFPA 70.

OFCI: Owner Furnished, Contractor Installed

OFOI: Owner Furnished, Owner Installed

Provide: Furnish and install in complete working order.

1.5 GENERAL

A. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. Each Contractor shall be governed by any alternates, unit prices and addenda or other contract documents insofar as may affect the work or services.

C. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of the complete and operating Electronic Safety and Security System(s) indicated and/or specified in the Contract Documents.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electronic Safety and Security Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.

E. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensation.

F. It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime agreement, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the Contractor to the Architect (if applicable), then to the Engineer.

G. This section of the Specifications or the arrangement of the Contract Documents shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

H. It is the intent of this Contract to deliver to the Owner a new and complete project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

I. In general, and to the extent possible, all work shall be accomplished without interruption of facility operations. The Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owner shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

J. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

K. Contractor shall not proceed with changes to scope of work and/or substitutions of specified materials without a signed approval by the Owner. Owner reserves the right to refuse payment for work appurtenant to changes and/or substitutions where such work was performed without signed approval. Refer to Division 01 specifications for detailed change and substitution procedures.

1.6 DRAWINGS AND SPECIFICATIONS

A. The Drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work.

B. The Drawings and Specifications are intended to supplement each other. No Contractor shall take advantage of conflict between them, or between parts of either. This also includes potential conflicts with regards to equipment and material model numbers, part numbers, etc. and respective description and/or performance. Should this condition exist, the Contractor shall request a clarification not less than 10 days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

C. The Drawings and Specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. Contractor shall make all necessary and required measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of conduit, j-hooks, devices, etc. where such adjustments are in the interest of concealing work or presenting a better appearance. Unless a formal proposal request is issued, this work shall be performed without additional cost to the Owner.

F. Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Communications equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.

G. Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

H. The Drawings are intended to show the approximate locations of equipment, materials, devices, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to ensure no conflict with other work. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.

I. Where on the Drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work without additional cost to the Owner, the same as if herein specified or indicated.

K. Where on the Drawings or Addenda the word typical is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

1.7 SUBSTITUTION PROCEDURES

A. Comply with provisions of Division 01 Section “Substitution Procedures”.

B. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.

C. If an alternate material is proposed that is equal to or exceeds specified requirements, Contractor shall provide manufacturers’ specifications in writing for Owner approval prior to purchase and installation.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. Substitutions of material by the Contractor shall be in writing complete with written manufacturers’ specifications. The material substituted shall not void, alter or change manufacturers’ system warranties.

F. Substitutions will not be considered when they are indicated or implied on submittals without separate written request or when acceptance will require revision to the Contract Documents.

G. The Owner will be the final judge of acceptability, with review by Engineer and the distribution of the acceptance by the Architect.
   1. No substitute shall be ordered, installed or utilized without the Architect's prior written verification of acceptance from the Owner.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Contractor shall supply all city, county, and state permits required by Authorit(ies) Having Jurisdiction.
   2. Contractor shall be state-licensed and/or bonded as required for installation of the system(s) Contractor proposes to install.

B. Certifications
   1. Contractor shall submit an up-to-date and valid certification verifying qualifications of the Contractor and installers to perform the work specified herein at time of bid submission.
   2. Contractor shall have a complete working knowledge of electronic safety & security systems cabling applications such as, but not limited to data, voice and video network systems.
   3. Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
   4. Contractor shall submit evidence of compliance with these requirements prior to beginning work on the project.
   5. Cabling installers shall be trained and certified by the cable manufacturer for telecommunication cabling installations and maintenance of said materials.
   6. Maintain current status with the warranting manufacturer, including all training requirements, for the duration of the project. Staff each installation crew with the appropriate number of trained personnel, in accordance with their manufacturer/warranty contract agreement, to support the specified system warranty requirements. After installation, submit all documentation to support system warrant(ies) in accordance with the manufacturer's warranty requirements, and to apply for said warrant(ies) on behalf of the customer.

C. Administrative Requirements and Coordination requirements
   1. Coordinate work of this section with Owner's telephone system specifications, workstations, equipment suppliers, and installers.
   2. Coordinate installation work with other crafts (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc) to resolve procedures and installation placement for cable trays and cable bundle pathways.
      a. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components.
      b. Damage by Contractor to the craft work of others will be remedied at the Contractor's expense in a timely manner.
   3. Exchange information and agree on details of equipment arrangements and installation interfaces.
      a. Record agreements reached in meetings and distribute record to other participants, Owner and telecommunication consultant.

4. Adjust arrangement and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment.
    a. Tasks shall be coordinated with Owner or his representative, and other trades' installation representatives.
5. When requested by Owner or Owner's representative, furnish extra materials that match specified products and that are factory packaged with protective covering for storage and identified with labels describing contents.

D. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.

E. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. Perform the following:
1. Promptly notify the Engineer in writing of any such difference.
2. Obtain approval from Engineer before proceeding with the Work.
3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.

F. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:
1. Promptly notify the Architect in writing of any such difference.
2. Obtain approval from Architect before proceeding with the Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.

B. Contractor requirements:
1. Be responsible for prompt material deliveries to meet contracted completion date.
2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
4. Equipment shall be delivered in original packages with labels intact and identification clearly marked.
5. Equipment shall not be damaged in any way and shall comply with manufacturer's operating specifications.
6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants.
    a. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
7. Contractor shall be responsible for all handling and control of equipment. Contractor is liable for any material loss due to delivery and storage problems.

C. Owner/General Contractor shall supply a list of security requirements for Contractor to follow.

1.10 PROJECT/SITE CONDITIONS

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Contractor will remove burrs, dirt, and construction debris.
   1. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions.

B. Contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.

C. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles.
   1. If any liquid or other detriment (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

1.11 COORDINATION

A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items. Also, where the description is general in nature, the exact sizes, duties, space arrangements, and other requirements must be obtained by reference to other portions of Contract Documents.

B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Firestopping" and in this Section.

F. Roof-Mounted Equipment: Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.12 WARRANTY

A. Contractor shall provide a minimum one (1) year warranty on installation and workmanship.

1.13 MAINTENANCE

A. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty or Extended Warranty period.

PART 2 PRODUCTS

2.1 IDENTIFICATION (LABELING) SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady
2. Brother
3. Dymo
4. Hellerman-Tyton

2.2 FIRESTOP SYSTEMS

A. General:
1. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
2. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

B. Manufacturers: Subject to compliance with requirements and with through-penetration firestop systems listed in Volume 2 of the UL Fire Resistance Directory, provide products by Specified Technologies, Inc. (STI) or Engineer approved equal.

C. Materials:
1. Firestop Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
a. STI SpecSeal Series SSS Sealant.
b. STI SpecSeal Series LCI Sealant.
2. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
a. STI SpecSeal Series SSP Putty.
3. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:
a. STI SpecSeal Series SSB Pillows.
4. Fire-Rated Cable Grommet: Molded, two-piece grommet with an integral fire and smoke sealing foam membrane for sealing individual cable penetrations through framed wall assemblies. Grommet snaps together around cable and locks tightly into the wall. The following products are acceptable:
a. STI EZ-Firestop Grommets.
5. Fire-Rated Cable Pathways: Device modules comprised of steel pathway with self-adjusting intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
a. STI EZ-PATH Fire Rated Pathway.

2.3 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, with burrs removed and insulating bushing fittings on ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.
1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.4 GROUT

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Field Measurements
1. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings.
2. Coordinate fabrication schedule with construction progress to avoid delaying the work.

B. Established Dimensions
1. Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field measurements.
2. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

3.2 PREPARATION

A. Contractor’s RCDD shall review, approve and stamp all Shop Drawings, Submittal Documents, Coordination Drawings and As Built Drawings.

B. Pre-Installation Inspection:
1. Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.
2. Visibly damaged goods are not acceptable and shall be replaced by the Contractor at no additional cost to the Owner.

3.3 IDENTIFICATION AND LABELING

A. Cable labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

B. Flat-surface labels: Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.

C. Refer to section 27 00 00 - Common Communications Requirements for cabling color code for division 27 and 28 systems.

3.4 CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATION, ETC.

A. Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, extensions, etc. in connection with his work.

B. Contractor shall file all necessary plans, utility easement requests and drawings, survey information on line locations, load calculations, etc. prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.

C. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall be versed in all Codes, Rules and Regulations pertinent to the work prior to submission of a proposal.

D. Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

E. Where minimum code requirements are exceeded in the Design, the Design shall govern.

F. Ensure that the work is accomplished in accordance with the OSHA Standards and any other applicable government requirements.

G. All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction.

H. Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

3.5 CUTTING AND PATCHING

A. Unless otherwise indicated or specified, each Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

B. Each Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. Contractor shall coordinate with the General Contractor any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.

C. Each Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching as well as reinforcement required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

D. Cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

E. Notify other trades in due time where openings of chases in new concrete or masonry are required. Set all concrete inserts and sleeves for work. Failing to do this, cut openings for work and patch same as required at own expense.

F. Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

G. No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

H. Each Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Engineer.

I. All work improperly done or not done at all as required by the Communications trades in this section will be performed by the General Contractor at the direction of the Contractor whose work is affected. The cost of this work shall be paid for by the Contractor responsible.

3.6 SLEEVES AND PLATES

A. Provide and locate all sleeves and inserts required for work before the floors and walls are built or be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

B. Galvanized steel sleeves shall be provided for all communications conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction.

C. Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.

D. In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.

E. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:
1. Sleeves shall protrude 2 in. beyond penetrated walls, partitions and ceiling.
2. In areas where conduits are concealed, as in chases, terminate sleeves flush with floor.
3. In all areas where conduits are exposed, terminate sleeves 2 in. above finished floor.

F. Sleeves shall be constructed of 24-gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.

G. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

H. Sleeves passing through exterior wall (none are permitted thru roof) or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed. All roof penetrations shall be made inside mechanical equipment curbs.

I. All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.

3.7 WEATHERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. Furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

B. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

3.8 FIRESTOPPING

A. Refer to Division 07 Section “Firestopping” for additional requirements.

B. Preparation:
1. Examination of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Do not proceed until unsatisfactory conditions have been corrected.

C. Through-Penetration Firestop System Installation:
1. Install through-penetration firestop systems in accordance with the conditions of testing and classification as specified in the published design.
2. Comply with manufacturer’s instructions for installation of through-penetration firestop systems products.
3. Seal all openings or voids made by penetrations to ensure an air and water resistant seal.
4. Protect materials from damage on surfaces subjected to traffic.

D. Do not penetrate rated fire walls, ceilings or floors with conduit, cable, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the fire-rating of the assembly. Firestop all openings made in walls, chases, ceilings and floors. Patch all openings around conduit, wireway, etc., with appropriate type material to provide needed fire rating at fire walls, ceilings and floors. Fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

E. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly.

F. Apply putty pads to boxes located in fire-rated wall assemblies in which a horizontal distance of greater than 24” between boxes is not maintained.

G. Install and seal penetrations (conduit, sleeves, slots, chases) into or through fire-rated barriers created by or made for or on the behalf of the Contractor to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.

H. Coordinate firestopping procedures and materials with General Contractor.

I. Solutions and shop drawings/submittals for firestop materials and systems shall be presented to the General Contractor for written approval of materials/systems prior to purchase and installation.

J. Following the pathway of others through compliant and non-compliant penetrations does not remove the requirement to maintain code-compliant firestopping.

K. Supply Owner with training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

L. Provide manufacturer recommended material for rated protection for any given barrier.

M. Laminate and permanently affix adjacent to chases the following information:
1. Manufacturer of firestop system
2. Date of installation/repair.
3. Part and model numbers of system and all components
4. Name and phone numbers of local distributor and manufacturer’s corporate headquarters

N. The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and maintain the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

3.9 TESTING

A. Upon completion of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.
1. Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
2. Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
3. Cable/jack shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
    a. Any removal and reinstallation of any component in the circuit shall require retesting of that circuit.
4. Approved instruments, apparatus, services, and qualified personnel shall be utilized.

5. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
6. Manipulation of tester parameters on a failing test in order to achieve a passing test is unacceptable.
7. If the Contractor is found to have manipulated or falsified any failing test result to show a “PASS” for any reason (without written notice and prior approval of the Owner), the Contractor shall be required to employ a Third-Party Testing Agent selected by the Owner to retest the complete cable plant and shall be required to pay all costs associated with this retesting.

B. These specifications will be strictly enforced.
1. The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing parameters listed elsewhere), and documentation as specified below.
2. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at final walk-through in soft copy and printed test data.

C. Notification of the likelihood of a cable exceeding standardized lengths must be made prior to installation of the cable.
1. Without contractor’s prior written notice and written approval by the Owner, testing that shows some or all pairs of cable not meeting specifications, shall be replaced at Contractor’s expense (including respective connectors).
2. With the Owner’s written approval, the over-length cable(s) shall be excluded from requirements to pass standardized tests and shall be explicitly identified.

D. Testing is still required for non-compliant cabling.
1. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to- ground.
2. The test results must be within acceptable tolerances and shall be submitted with the Owner’s acceptance document.

E. Contractor will complete all work and documentation according to manufacturer guidelines to ensure manufacturer’s warranty remains in effect.
1. Contractor shall obtain certificates from manufacturer attesting to warranty being in effect and include certificates with other deliverables due at the completion of the project.

F. Owner reserves the right to be present during any or all testing.

3.10 SCAFFOLDING, RIGGING AND HOISTING

A. Furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required in strict accordance with OSHA Guidelines.

3.11 OPTION TO RELOCATE DEVICES

A. The location of voice and data outlets and other similar devices along with their associated connections may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to rough-in or installation.

3.12 CLEANING

A. Work areas will be kept in a broom clean condition throughout the duration of the installation process.

B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

C. The Contractor will damp clean all surfaces prior to final acceptance by Owner.

D. After completion of all work and before final acceptance of the work, thoroughly clean all equipment and materials and remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of equipment, fixtures and all other associated or adjacent fabrication.

3.13 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted, and Owner is satisfied that all work is in accordance with contract documents, the Owner shall notify Contractor in writing of formal acceptance of the system.

B. Contractor must warrant in writing that 100% of the installation meets the requirements specified herein (Standards Compliance & Test Requirements).

C. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation soft and hard copies as describe herein.

3.14 INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

3.15 HAZARDOUS MATERIALS

A. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, ensure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

END OF SECTION

SECTION 28 05 03 - ELECTRONIC SAFETY AND SECURITY SHOP DRAWINGS AND SUBMITTALS

PART 1 GENERAL

1.1 SHOP DRAWINGS AND SUBMITTALS

A. Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, sets of shop drawings and/or manufacturer's descriptive literature (coordinate exact quantity with architectural specifications) on all equipment required for the fulfillment of his contract. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced per the specifications and/or schedules, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

B. If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

C. Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

D. The Engineer's review of shop drawings, schedules, product data or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

E. No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

F. In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:
   1. Raceways:
      a. Conduit (each type).
      b. Bridle ring assembly.
      c. J-hook assembly.
      d. Junction, pull, and device boxes

2. Systems: Each system submittal is to be complete with legible cutsheets for all devices, equipment, special wiring, etc. Also, provide scaled building layout drawings that indicate device placement, wiring, etc. Refer to the specific system's specification for additional submittal requirements where required.
   a. Emergency Responder Radio Antenna System
   b. Access Control System and Hardware Devices
   c. Intrusion Detection System
   d. Fire alarm system.
3. Miscellaneous
   a. Control panel assemblies.
   b. Non-standard junction/pullboxes

G. Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, comply with the following:
1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with “Compliance”. Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
   a. “C” for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
   b. “D” for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
   c. “A” for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
   d. “N/A” for Not Applicable: By noting the term “not applicable” or “N/A” in the margin, it shall be understood that the specified item is not applicable to the project.

1.2 SPECIAL WRENCHES, TOOLS AND KEYS

A. Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, etc. and keys to alarm pull boxes, panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

1.3 FIRE ALARM SHOP DRAWINGS

A. The Contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm system shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to submittal to the authority having jurisdiction for their review.

1.4 MAINTENANCE AND OPERATION MANUALS

A. Upon substantial completion of the project, the Electrical Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) three complete copies of operation and maintenance instructions and parts lists for all equipment provided. These documents shall at least include:
1. Detailed operating instructions.

2. Detailed maintenance instructions including preventive maintenance schedules.
3. Addresses and phone numbers indicating where parts may be purchased.
4. Reference architectural specifications for additional requirements.

B. Refer to individual contract document specification sections for additional requirements.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 28 05 10 - SCOPE OF THE ELECTRONIC SAFETY AND SECURITY WORK

PART 1 GENERAL

1.1 SUMMARY

A. Each Contractor's attention is directed to Section 28 00 00 – Common Electronic Safety and Security Requirements and all other Contract Documents as they apply to his work.

1.2 SCOPE

A. The Electronic Safety and Security work for this project includes all labor, materials, equipment, devices, and related items required to completely install, test, place in service and deliver to the Owner complete safety and security systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:
   1. All j-hooks, fittings, etc.; coordinate with Division 26.
   2. All wiring devices and device plates.
   3. All system hardware, equipment and installation.
   4. All programming, scheduling and testing.

B. Grounding, per NEC and the specified requirements.

C. All necessary fees and cost for permits, inspections, etc.

D. Coordination with Division 21 for interface with fire suppression systems.

E. Coordination with Division 23 for interface with HVAC systems and instrumentation and control system.

F. Coordination with Division 26 for power, rough-in, conduit and pathways.

G. Coordination with Division 27 for low voltage structured cabling and intercommunications and program systems.

H. Access control system and hardware devices as indicated.

I. Intrusion detection system as indicated.

J. Cabling for video surveillance system as indicated in communications copper horizontal cabling specification.

K. Fire alarm system as indicated.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 28 10 00 - ACCESS CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. SECTION INCLUDES
1. Access control system requirements.
2. Access control units and software.
3. Access control point peripherals, including readers and keypads.
4. Accessories.

B. RELATED REQUIREMENTS
1. Section 08 71 00 - Door Hardware: Electrically operated door hardware, for interface with access control system.
   a. Includes door hardware with integral request to exit devices.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 33.13 - Conduit for Electrical Systems.
4. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
5. Section 28 46 00 - Fire Detection and Alarm: For interface with access control system.

1.2 DEFINITIONS

A. Abbreviations:
1. AD – Active Directory, a Microsoft Windows computer network authentication and access management system
2. API – Application Programming Interface
3. GB – Gigabytes, meaning 10^9 bytes
4. IEC – International Electrotechnical Commission
5. IEEE – Institute of Electrical and Electronics Engineers
6. IKxx (where xx is a 2-character designation) – Impact protection rating, per IEC 62262.
7. IP – Internet Protocol, an OSI Layer 3 communication protocol for interconnecting computer networks
8. IPxx (where xx is a 2-character designation) – Ingress protection rating, per IEC 60529.
9. ISO – International Organization for Standardization
10. LDAP – Lightweight Directory Authentication Protocol, an open standard computer network authentication and access management system
11. OSDP – Open Supervised Device Protocol, a standard for encrypted serial communication between credential reader and access control hardware system developed by SIA and published as IEC 60839-11-5.
12. PoE – Power over Ethernet
13. RAS: Remote access services.
14. RF: Radio frequency.
15. RS-485: Serial Communication protocol in accordance with TIA-485.
16. SIA: Security Industry Association
17. TCP/IP: Transport control protocol/Internet protocol.
18. TCP – Transmission Control Protocol
19. UDP – Uniform Datagram Protocol
20. Wi-Fi – Wireless Ethernet as defined by the IEEE 802.11 standards.
21. WYSIWYG: What You See Is What You Get. Text and graphics appear on the screen the same as they will in print.

B. Credential: Data assigned to an entity and used to identify that entity.

C. Identifier: A credential card; keypad personal identification number; or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

D. Location: A Location on the network having a workstation-to-controller communications link, with additional controllers at the Location connected to the workstation-to-controller link with a TIA 485-A communications loop. Where this term is presented with an initial capital letter, this definition applies.

E. Wiegand (Effect): Patented magnetic principle that uses specially treated wires embedded in the credential card.

F. Wiegand (Standard): Wiring and protocol specification for communication between credential reader and access control hardware system

1.3 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IEC 60839-11-5 - Alarm and electronic security systems - Part 11-5: Electronic access control systems - Open supervised device protocol (OSDP); 2020.

C. IEC 62262 - Degress of Protection Provided by Enclosures (IK Code); 2021.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

F. TIA-485 - Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems; 1998a (Reaffirmed 2012).

G. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

H. UL 1076 - Proprietary Burglar Alarm Units and Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
3. Coordinate the work with other installers to provide power for equipment at required locations.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:
1. Attend meeting with Engineer, Owner representative, Prime Contractor representative, Door Hardware subcontractor and other related equipment manufacturers to review electronically controlled door locations and verify scope coverage.

1.5 ACTION SUBMITTALS

A. Product Data:
1. Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
2. Submit sample of Manufacturer's Warranty.

B. Shop Drawings:
1. Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables.
2. Include elevations and details of proposed equipment arrangements.
3. Include system interconnection schematic diagrams.
4. Include requirements for interface with other systems.
5. Design Data: Standby battery/UPS calculations.

1.6 INFORMATION SUBMITTALS

A. Specification Compliance Certification: Certify that proposed system design and components meet or exceed specified requirements in accordance with section 28 05 03 - Electronic Safety and Security Shop Drawings and Submittals.

B. Evidence of qualifications for installer.

C. Field quality control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

B. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

C. Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.8 QUALITY ASSURANCE

A. Comply with the following:
1. NFPA 70.
2. The requirements of the local authorities having jurisdiction.
3. Applicable TIA/EIA standards.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.
1. Contract maintenance office located within 100 miles of project site.

C. Maintenance Contractor Qualifications: Same entity as installer.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions, including storage in a temperature- and humidity-controlled location.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.10 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

B.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Access Control Units:
1. Mercury: https://mercury-security.com/.

B. Access Control Software:
1. Acre Security, Inc (formerly OpenOptions); DNA Fusion: https://acresecurity.com/access-control-solutions/dna-fusion-on-premise-access-control.

C. Readers and Keypads:
1. Schlage; MT-Series RS485 variant: https://commercial.schlage.com/en/products/readers.html.

2.2 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Surge Protection:
1. Provide surge protection for readers and door strikes/locks.

C. Interface with Other Systems:
1. Provide products compatible with other systems requiring interface with access control system.
2. Interface with electrically operated door hardware as specified in Section 08 71 00.
   a. Capable of locking/unlocking/releasing controlled doors.
   b. Capable of receiving input from integral door hardware switches.
3. Interface with fire alarm system as specified in Section 28 46 00.
   a. Capable of affecting access for designated doors for selected fire alarm system events.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.3 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and software compatible with readers to be connected.

B. Unless otherwise indicated, provide software and licenses required for fully operational system.

C. Access Control Unit - IP Intelligent Main Controller:
1. Product: Subject to requirements, provide Open Options (by Acre) #SSP-LX. Substitutions by written Owner approval only.
2. Control Capability: Up to 64 access points.
3. Database:
   a. Storage Capacity: 2,000,000 cardholders; 50,000 events.
4. Alarm Inputs: eight (8) onboard.
5. Output Relays: four (4) onboard.
6. Features:
   a. Dedicated tamper alarm input.
   b. Dedicated power loss alarm input.
   c. Supports RS-485 and OSDP.

D. Access Control Unit - Dual Reader Interface Module:
1. Product: Subject to requirements, provide Open Options (by Acre) #RSC-2. Substitutions by written Owner approval only.
2. Control Capability: Up to two access points.
3. Alarm Inputs: eight (8).
4. Output Relays: six (6).
5. Features:
   a. Dedicated tamper alarm input.
   b. Dedicated power loss alarm input.
   c. Supports RS-485 and OSDP.

E. Access Control Power Supply:
1. Basis-of-Design Product: Subject to requirements, provide LifeSafety Power #FlexPower MCLASS series or approved equal.
2. Power supply enclosure shall house power supply electronics plus up to four (4) ACS control boards.
3. Inlet Power Characteristics:
   a. 120/230 VAC 50/60 Hz, 170 W (1.41 A).
   b. Overload and short circuit protection.
   c. Over-temperature protection.
   d. Polarized AC power supply disconnect.
4. Output Power Characteristics:
   a. Eight (8) control outputs, fused at 3 A each.
   b. Eight (8) auxiliary outputs, class II rated at 2.5 A per output.
   c. Total output power: 4A @ 12V and 4A @ 24V DC, 150W all channels combined.
5. Battery Backup & Charging:
   a. Automatic switchover to standby battery when AC fails.
   b. Integral 2A charger for SLA or gel cell type batteries.
   c. Microprocessor dual rate charging of 12 or 24V battery sets.
   d. Charges up to 80Ah battery sets within UL limit.
6. Regulatory Compliance: UL 294, UL 603, UL 1076, FCC Part 15.

2.4 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units and software.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Readers and Keypads:
1. General Requirements:
a. Provide readers compatible with credentials to be used.
b. Color: To be selected by Architect from manufacturer's available standard colors.
2. Multi-technology Reader | Standard form factor with keypad ('CK'):
a. Product: Subject to requirements, provide Schlage #MTK15-485. Substitutions by written Owner approval only.
b. Credentials Supported: Communicates with 13.56 MHz smart cards, 125 kHz proximity cards, and near-field communication (NFC) credentials.
c. Output Interface: RS-485.
d. Features:
1) Tamper output.
2) Keypad.
3. Multi-technology Reader | Standard form factor ('CR'):
a. Product: Subject to requirements, provide Schlage #MT15-485. Substitutions by written Owner approval only.
b. Credentials Supported: Communicates with 13.56 MHz smart cards, 125 kHz proximity cards, and near-field communication (NFC) credentials.
c. Output Interface: RS-485.
d. Features:
1) Tamper output.
4. Multi-technology Reader | Mullion form factor ('CR_M'):
a. Product: Subject to requirements, provide Schlage #MT11-485. Substitutions by written Owner approval only.
b. Credentials Supported: Communicates with 13.56 MHz smart cards, 125 kHz proximity cards, and near-field communication (NFC) credentials.
c. Output Interface: RS-485.
d. Features:
1) Tamper output.

D. Door Position Switches:
1. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors.
2. Provide contacts with DPDT Terminal Configuration. Intrusion alarm and access control system shall use separate terminals on the same device.
3. Basis-of-Design Products:
a. Steel Doors: George Risk Industries #195-12.
b. Non-Ferrous Doors: George Risk Industries #175-12.
or comparable products by Engineer approval..

E. Request to Exit Devices:
1. Door Hardware with Integral Request to Exit Switches: Comply with Section 08 71 00. Supervise active leaf contacts for door forced; supervise both leaves for door propped.

F. Door Locking Devices (Electric Locksets & Str): Comply with Section 08 71 00.

2.5 REMOTE RELEASE DEVICES

A. Remote Release Pushbutton | Wall-Mount Type (RR1):

1. Provide wall-mounted momentary pushbutton with green housing and "DOOR RELEASE" text legend.
2. Product: Provide STI #SS2104ZA "DOOR RELEASE". Substitutions by written Owner approval only.

B. Remote Release Pushbutton | Under-Desk Rocker Type (RR2):
1. Provide under-desk mounted momentary pushbutton with surface mounted housing and rocker type action.
2. Product: Provide RCI #909S-MOW. Substitutions by written Owner approval only.

2.6 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.
1. Provide credentials compatible with readers and control units/software to be used.
2. Credential Type: XceedID 9500 series Smart Cards.
a. Quantity: 100.
b. Coordinate with Owner prior to ordering.

C. Provide cables as indicated or as required for connections between system components.

D. Provide end-of-line resistors (EOLR) as required for supervision of hardwired connections.

E. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that mounting surfaces, doors, frames, etc. are ready to receive system components.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. System Physical Configuration: Locate all access control head end equipment, power supplies, etc. at central data closet / MDF as indicated on plans. Power supply for access control boards, door hardware, readers, and all other system components shall be located at the closet. AC power will not be provided at the door.

D. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
1. Use suitable listed cables in wet locations, including underground raceways.
2. Use suitable listed cables for vertical riser applications.
3. Use listed plenum rated cables in spaces used for environmental air.
4. Install wiring in conduit for the following:
a. Where required for rough-in (access across inaccessible ceiling condition, etc).
b. Where required by authorities having jurisdiction.
c. Where exposed to damage.

d. Where installed outside the building.
e. Where indicated on plans.

5. Conduit: Comply with Section 26 05 33.13.
6. Conceal cables unless specifically indicated to be exposed.
7. Use power transfer hinges / devices complying with Section 08 71 00 for concealed connections to door hardware.
8. Route exposed cables parallel or perpendicular to building structural members and surfaces.
9. Do not exceed manufacturer's recommended maximum cable length between components.

E. Provide grounding and bonding in accordance with Section 26 05 26.

F. Identify system wiring and components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

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

B. Prepare and start system in accordance with manufacturer's instructions.

C. Program system parameters according to requirements of Owner.

D. Test for proper interface with other systems.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 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. Provide minimum of four hours of training.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed system.
4. Location: At project site.

END OF SECTION

SECTION 28 31 11 - INTRUSION DETECTION SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor is directed to examine each and every section of these specifications, all drawings relating to the Contract Documents, any and all Addenda, etc., for work described elsewhere that may relate to the provision of the work described herein. Materials and performance requirements are specified elsewhere herein that relate to these systems.

1.2 MANUFACTURERS

A. The manufacturer shall have at least fifteen (15) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of fifteen (15) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.

B. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines, network, and cellular network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.

C. Intrusion Detection/Access Control Panel equipment manufacturer shall be:
Digital Monitoring Products, Incorporated (DMP)
2500 N. Partnership Boulevard,
Springfield, MO 65803
Telephone (417) 831-9362
FAX (417) 831-1325

1.3 INSTALLER

A. The installing company shall show proof of having regular experience with design, installation, service, and maintenance of manufactured systems for a minimum of the last five (5) years from the project start date. Each system installer and service person must provide manufacturer certification of technical training for installation, service, and system maintenance. Certification shall be proven with an official document issued by the manufacturer.

B. The installing company shall furnish and install a complete electrically supervised DMP panel, as detailed in this specification. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.

C. The installing company shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work. Materials shall be installed in strict compliance with local building codes. All work shall be performed in accordance with Digital Monitoring Products, Inc. instructions. Components must be installed and serviced by a dealer in good standing that is factory-trained by Digital Monitoring Products.

PART 2 SCOPE

2.1 REQUIREMENTS

A. Furnish and install a complete Intrusion Detection Panel with the performance criteria detailed in this specification. The system shall be inclusive of all necessary functions, monitoring, and control capability as detailed herein and on accompanying Shop drawings.

B. This specification document provides the requirements for the installation, programming, and configuration of a complete DMP panel. This system shall include, but not be limited to:
1. Control panel
2. System cabinet
3. Power supply
4. Digital Signaling Line Circuits (SLC)
5. Keypad bus
6. Batteries
7. Wiring
8. Associated peripheral devices
9. Other relevant components and accessories required to furnish and install a complete and operational addressable reporting system.

C. Refer to floorplans for all device locations and quantities.

D. Furnish all materials, labor, etc., that are indicated or required to provide wiring from each device indicated on plans to security panel in MDF. All conduit and boxes for all devices installed provided by Division 26 Electrical Contractor.
1. Division 26 Electrical Contractor shall provide blank covers on all unused cut-in boxes at close of project.
2. The system head end, devices, keypads, software, etc. shall be installed by the security contractor.
3. Division 27 Contractor to provide two (2) Cat 6 cables from the patch panel to the alarm panel. Cables shall be terminated at the patch panel by Division 27 Contractor. Intrusion detection installer shall terminate cables at Intrusion Detection Panel.

2.2 STANDARDS

A. All system installations shall be made in full compliance with the following:
1. National Electrical Code
2. Texas Building Code
3. ANSI C2-1981 National Electrical Safety Code 47
4. CFR Part 68
5. NFPA 75

B. The system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

BURGLARY LISTINGS	U.S. GOVERNMENT STANDARDS/LISTINGS
UL 1023 HOUSEHOLD BURGLAR ALARM SYSTEM UNITS	MEETS ICD 705 CHAPTER 7 INTRUSION DETECTION SYSTEMS (IDS)
UL 1076 PROPRIETARY BURGLAR	MEETS DOD/NIST SCIF STANDARDS
UL 1610 CENTRAL STATION BURGLAR ALARM UNITS	RELATED STANDARDS
UL 1635 DIGITAL BURGLAR ALARM COMMUNICATOR SYSTEM UNITS	NFPA 70 NATIONAL ELECTRIC CODE (NEC)

FIRE LISTINGS	NFPA 72 LOCAL PROTECTIVE SIGNALING
UL 864 CONTROL UNITS FOR FIRE PROTECTIVE SIGNALING SYSTEMS	NFPA 72 REMOTE STATION PROTECTIVE SIGNALING
UL 985 HOUSEHOLD FIRE WARNING	NFPA 72 PROPRIETARY PROTECTIVE SIGNALING
CALIFORNIA STATE FIRE MARSHAL	NFPA 72 HOUSEHOLD FIRE WARNING
NEW YORK CITY FDNY COA #6167	CANADIAN BURGLARY LISTINGS
ACCESS CONTROL LISTINGS	ULC C1023 HOUSEHOLD BURGLAR
UL 294 ACCESS CONTROL SYSTEM UNITS	ULC/ORD-C1076 PROPRIETARY BURGLAR
NIST	ULC S304 CENTRAL STATION BURGLAR
AES ALGORITHM CERTIFICATE #2350 128	CANADIAN FIRE LISTINGS
AES ALGORITHM CERTIFICATE #2595 256	ULC S545 HOUSEHOLD FIRE
	ULC S559 FIRE SIGNAL RECEIVING CENTRES AND SYSTEMS

PART 3 SUBMITTALS

3.1 GENERAL REQUIREMENTS

A. The contractor shall submit three (3) complete sets of documentation within thirty (30) calendar days after contract award date. Indicated in the document shall be the manufacturers' names, catalog number, type, size, style, rating, and catalog data sheets for all items proposed to meet these specifications.

B. Specification Compliance Certification: Submit a Specification Compliance Certification in accordance with Division 28 Section "Electronic Safety and Security Shop Drawings and Submittals".

3.2 SHOP DRAWINGS

A. Shop drawings shall be submitted in accordance with Section 3.01 General Requirements and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

3.3 AS-BUILT DRAWINGS

A. The contractor shall provide a complete set of as-built drawings for the entire system upon installation completion. These drawings shall include, but not be limited to, the exact locations of all equipment, connections between all equipment, and wiring for all equipment as the system is installed.

3.4 SPARE PARTS DATA

A. After shop drawings are approved, and not later than thirty (30) calendar days prior to the date of beneficial occupancy, a list of spare parts data for each item of specified materials and equipment shall be submitted. The data shall include a complete list of parts and supplies with current unit prices and source of supply. Spare parts shall consist of, but not be limited to, five (5) percent of all initiating and notification appliances with a minimum of one (1) each. All spare parts shall be on site prior to commencement of acceptance testing. Depleted spare parts shall be replaced prior to beneficial occupancy.

3.5 OPERATING DOCUMENTS

A. The contractor shall furnish to the architect operating instructions outlining the step-by-step procedures required for system start-up, operation, and shutdown at least thirty (30) calendar days prior to acceptance test. The instructions shall include the manufacturer's name, system model number, service manual, parts list, and a description of all equipment and their basic operating features.

3.6 MAINTENANCE DOCUMENTS

A. The contractor shall furnish maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides at least 30 calendar days prior to acceptance test.

3.7 PERFORMANCE TEST REPORTS

A. Upon the installed system completion and testing, test reports shall be submitted in booklet form showing all field tests performed to prove compliance with specified performance criteria.

B. WARRANTY

C. A copy of the manufacturer's warranty for all equipment and materials shall be provided. Warranty shall be for all equipment, materials, installation, and workmanship for a minimum of one (1) year, unless otherwise specified.

PART 4 GENERAL COMPONENT REQUIREMENTS

4.1 COMPONENT ENCLOSURE

A. Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18-gauge door with a 20-gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tampers listed for use with the XR550 with Network and Encryption shall be used.

4.2 ELECTRONIC COMPONENTS

A. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.

B. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and Loop Expansion LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the Loop Expansion LX-Bus(es) and Keypad bus are shut down.

4.3 CONTROL UNIT

A. A battery test shall be automatically performed to test the integrity of the standby battery. The test shall disconnect the standby battery from the charging circuit and place a load on the battery. This test shall be performed no more than every 180 seconds.

B. The control unit shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.

C. Control unit must be “Flash ROM” updatable, and program must be held in non-volatile RAM. The panel shall be able to function while the update is in process.

D. Control unit shall be capable of operating using an optional built in Encrypted Alarm Router for SCIF (Sensitive Compartmented Information Facility) application that is certified by NIST (National Institute of Standards and Technology) for 128-bit or 256-bit AES (Advanced Encryption Standard) Encryption communications.

E. The optional built-in Encrypted Alarm Router shall be capable of compliance with ICD 705 Chapter 7 Intrusion Detection Systems (IDS) and UL 2050 standards.

4.4 CONTROL DESTINATIONS

A. Controls shall be provided to ensure ease of operation of all specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function; controls, switches, visual signals and indicating devices, input and output connectors, terminals and test points shall be clearly marked or labeled on the hardware to permit quick identification of intended use and location.

4.5 TEST FUNCTION

A. The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.

B. The system shall include a provision for an automatic, hourly, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.

C. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.

4.6 POWER SUPPLIES

A. Power supplies for the control unit shall operate from 120 Vac, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.

B. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.

C. Approved power supplies shall meet or exceed the following power supply model specifications:
   1. UL Listed DMP 505-12: 12Vdc 5 Amp with transformer and enclosure.

4.7 SOFTWARE

A. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:
   1. Direct cable connection interface card
   2. Receiver phone line connection
   3. Standard phone line connection
   4. Ethernet network connection
   5. Network connection across the Internet
   6. Cellular network connection using the 263C or 263H Cellular Communicators

B. The system shall interface with computer software capable of locking down all controlled doors.

C. The system shall interface with computer software capable of monitoring and logging all events.

D. The system shall interface with computer software capable of exporting reports in the following file formats:

Excel spreadsheet (*.xls	Text (*.txt)
Rich Text (*.rtf)	Comma-separated (*.csv)
Windows Metafile (*.wmf)	HTML document (*.htm)
QuickReport (*.qrp)	

E. The system shall interface with computer software capable of printing custom, filtered reports including:

All Events	User Code Changes
Zone Action	Opening/Closing Schedule Changes
Arming/Disarming	System Monitors
Area Late to Close	System Events

4.8 CONTROL PANEL CAPABILITY

A. The basic control panel shall provide:
   1. Expansion to a total of at least 10,000 user codes with 99 user profile definitions.
   2. Temporary user codes that can be entered with a finite date and specific time to expire.
   3. Sixteen (16) independent door/keypad addresses, each with four zones on XR550.
   4. A total of at least 99 programmable Schedules for output relay schedules, area schedules, holiday schedules, and user profiles. The same schedule may be assigned to more than one area, door, or output, making them reusable. There shall be at least two schedules per user profile with up to four profiles per user. Up to 8 Schedules per user, per door, per area, and per output.
   5. Thirty-two (32) individual reporting areas XR550.
   6. Built-in bell and telephone line supervision.

B. The networked control panel shall provide the entire above plus:
   1. Require two-man access code or credentials. Require two user code entries to disarm and/or allow door access to this area.
   2. Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.
   3. Early Morning Ambush. Must disarm a second time with in a programmed period of time or an early morning ambush silent alarm is sent.

4. Bank Safe & Vault features. Schedules set for this area and the time of day cannot be changed while the area is armed.

C. The XR550 encrypted control panel shall provide the entire above plus:
1. Built-in Encrypted Alarm Router.
2. Certified operation that meets NIST (National Institute of Standards and Technology) standards for
128-bit and 256-bit AES (Advanced Encryption Standard) Encryption.
3. Certification that encrypted panel is capable of meeting ICD 705 Chapter 7 Intrusion Detection Systems (IDS) Standard.
4. Certification that encrypted panel is capable of meeting UL 2050 standards.
5. Panic Test allows the panic zone test verification and failure results to be sent to the central station receiver.
6. Passphrase of 8-16 characters to validate encryption between the XR550 with Encryption and the Central Station Receiver.

PART 5 FUNCTIONAL DESCRIPTIONS:

5.1 SYSTEM DESCRIPTION

A. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.

B. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.

C. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.

D. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, Text messaging, or Smart Phone Application using integrated or auxiliary devices provided by the system manufacturer.

E. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/or wireless zone expansion equipment for at least 500 wireless zones and/or a maximum of 574 hardwired zones.

F. The system shall be capable of offering up to five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.

G. The system shall provide a seamless capability to provide up to 506 addressable relays, which can be located at any connection location upon a zone expansion bus.

H. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.

I. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.

J. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet, cellular communications paths.

K. The control unit shall be completely programmable remotely using remote annunciators, and/or using upload/download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.

L. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.

5.2 INPUT/OUTPUT CAPACITY

A. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 506 output relays.

B. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 Vdc and four open collector 12 Vdc outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 506 auxiliary relays (Form C rated at 1.0 Amp at 30 Vdc).

C. The panel shall also provide 99 programmable output profiles for schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.

D. The system shall be capable of supporting and controlling up to 232 Z-Wave devices and up to 20 Z-Wave Favorites for group control.

5.3 USER/AUTHORIZATION LEVEL CAPACITY

A. The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.

5.4 KEYPADS

A. The system shall support a maximum of sixteen (16) keypads on XR550 series with alphanumeric display. Each keypad shall be capable of arming and disarming any system area based on a pass code or Proximity key authorization. The keypad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.

B. Communication between the control panel and all keypads and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all keypads, zone expanders, output expanders, and other power consuming detection devices.

C. If at any time a keypad does not detect polling; the alphanumeric display shall indicate “SYSTEM TROUBLE”. If at any time two devices are programmed for the same address, the alphanumeric keypad shall display “4 WIRE BUS TROUBLE”. If at any time a keypad detects polling but not for its particular address, the alphanumeric display shall indicate “NON POLLED ADDR”. The system shall display all system troubles at selected keypads with distinct alphanumeric messages.

D. The keypad shall include self-test diagnostics enabling the installer to test all keypad functions: display test, key test, zone test, LED test, relay test, tone test, and address test.

E. The keypad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, keypad displays, and central station reports.

F. The keypad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.

G. The control panel shall support a keypad interface accessible on the World Wide Web in a browser window. The web-accessible keypad interface shall provide at least five (5) programmable hyperlinks for camera access or other use.

H. Keypad shall be DNP model 7073A-W.

5.5 ZONE CONFIGURATION

A. A minimum of four (4) Class B ungrounded zones shall be available at each keypad or zone expander on the system. The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders on the XR550. It shall also have the capacity of a maximum of 125 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.

B. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.

C. The digital SLCs and the annunciator/keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This distance may be extended to a total of 15,000 feet when bus repeater modules are installed.

D. Each zone shall function in any of the following configurations:

Night	Supervisory	Auxiliary 1	Cross-Zone
Day	Emergency	Auxiliary 2	Priority
Exit	Panic	Fire Verification	Arming
Fire			

5.6 COMMUNICATION

A. The system shall be capable of signaling to as many as 8 remote monitoring station receivers. Seven (7) of the eight (8) paths shall be capable of being assigned as either a “primary” or “backup” path. In such a manner, the system shall have multiple primary paths to multiple remote monitoring stations as well as multiple backup paths to multiple monitoring stations.

B. The system shall employ Adaptive Technology that allows a Backup communication path programmed for Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable. This creates a seamless transition for communication.

C. The system shall be capable of dialing up to (2) remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing sequence shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.

D. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least one other standard industry format.

E. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

F. The system shall utilize AISD Standard configuration of primary communication via cellular connection.

G. Security Contractor must install system to report under a single account, coordinate with Alvin ISD’s alarm monitoring vendor for account numbers, and provide complete and accurate zone lists to AISD monitoring vendor prior to system start-up.

5.7 NETWORK COMMUNICATION

A. The control panel shall be capable of asynchronous network communication with a retry time between 2 and 240 minutes and a fail time of 2 and 240 minutes. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.

B. The control panel shall employee adaptive communication technology. Adaptive Technology allows a Backup communication path programmed to use Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable, creating a seamless transition for communication of messages. Select Adapt when programming the Checkin option. This allows a system to be fully supervised even if a path fails, while also keeping wireless charges low when the network is good.

C. Network communication between the control panel and the receiver shall be in a proprietary communication format.

D. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.

E. Underwriters Laboratories (UL) shall list network communication by the control panel for Standard or Encrypted Line Security.

F. The control panel shall be capable of two-way network communication using standard Ethernet 10/100 BaseT in a LAN, WAN, or Internet configuration.

G. The control panel shall be capable of communication by means of a 128-bit or 256-bit AES (Advanced Encryption Standard) Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with an SCS-104 line card or SCS-VR (SCS-VR currently supports 128-bit encryption only).

H. The control panel shall be capable of meeting ICD 705 Chapter 7 Intrusion Detection Systems (IDS) and UL 2050 standards.

I. The control panel shall be capable of sending text messaging to up to three Cellular Phone Numbers using cellular communications.

J. The control panel shall be capable of sending the following SMS messages:

Zone Alarms by Zone Name	AC Power Trouble and Restoral
Zone Troubles by Zone Name	System Low Battery
Zone Bypass by User	Ambush
Arming (Closings) by User	Abort, Cancel and Alarm Verified by User
Disarming (Openings) by User	Check-in by user
Late to Close	

5.8 CELLULAR COMMUNICATIONS

A. The control panel shall have the capability to communicate with a plug-in cellular HSPA+ communicator model number 263H or CDMA communicator model number 263C that shall plug into the control panel J24 connector which shall supply full data communication and power to the 263H or 263C cellular communicator. The cellular communicator shall be capable of communicating full panel alarm and auxiliary messages to the DMP SCS-1R Central Station or SCS-VR Receiver as well as SMS text messaging to a PC, PDA, or Cellular telephone.

B. The control panel shall be capable of sending the following SMS messages

Zone Alarms by Zone Name	AC Power Trouble and Restoral
Zone Troubles by Zone Name	System Low Battery
Zone Bypass by User	Ambush
Arming (Closings) by User	Abort, Cancel and Alarm Verified by User
Disarming (Openings) by User	Check-in by user
Late to Close	

5.9 TCP/IP NETWORK TRAPPING

A. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the SCS-104 installed in an SCS-1R receiver.

B. The receiver SCS-104 shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver SCS-104 shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.

C. The trap message shall be stored in the receiver SCS-104 for up to four hours. If the trap message is not sent to the panel within the four-hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.

D. The user shall be able to view the trap status in the receiver SCS-104 inch Remote Link using the Trap Query function.

PART 6 INTEGRATED INTRUSION ALARM AND ACCESS CONTROL OPERATION

6.1 DESCRIPTION

A. Software interface to control and view DMP panel points and events through Open Options DNA Fusion.

6.2 OVERVIEW

A. An alarm panel can monitor multiple sites. Each site can consist of multiple zones/areas. An area can be a single alarm/monitoring point such as glass break or can include multiple zones in a contiguous area. If one of the zones goes into alarm within an area, then the user will be notified that a zone is in alarm.

B. The DMP panel is also the dialer. Alarm notification would be sent to a monitoring station where first responders are notified.

C. The DMP panel will initially be configured at the panel or via DMP's remote link software.

6.3 FUNCTIONALITY

A. Receive alarm panel events in Events/Alarm manager.

B. Arm and disarm DMP panel areas/zones via DNA Fusion through mouse controls or host based macros.

C. Send events to DMP panel so the DMP panel dials out to monitoring service.

D. Plot and control areas and zones on a graphics map

E. Setup host-based macros on areas/zones as designated by AISD Security Admin

F. Program DMP system to Auto-Arm at 11:00PM every night.

6.4 FEATURES

A. Single interface for displaying and monitoring intrusion detection system.

B. DNA Fusion can serve as the primary and secondary monitoring application.
1. Note: DNA Fusion is not UL 1076 (MET LABS) certified as an intrusion detection system.

C. Arm/Disarm the DMP panel from DNA Fusion without going to the panel.

6.5 NOTES

A. Integration does not support adding/removing users in the alarm panel.

PART 7 FALSE ALARM REDUCTION FEATURES

7.1 GENERAL

A. The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.

7.2 EXIT ERROR ALERT AND REPORTING

A. The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.

7.3 ENTRY AND EXIT DELAY ANNUNCIATION

A. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.

B. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.

7.4 REMOTE ANNUNCIATION

A. The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.

7.5 ABORT REPORTING

A. The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent after the alarm report to notify the central station that an authorized user has cancelled the alarm.

7.6 SYSTEM TESTING

A. The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.

7.7 AMBUSH CODE

A. The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.

7.8 TWO-BUTTON PANIC FEATURE

A. The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.

7.9 CROSS-ZONING PROTECTION

A. The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once. (NO CROSS-ZONES SHALL BE PERMITTED WITHOUT PRIOR WRITTEN APPROVAL FROM AISD SECURITY ADMIN)

7.10 SWINGER ZONE BYPASSING

A. The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.

7.11 RECENTLY ARMED REPORT

A. The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a “call the subscriber first” procedure instead of immediately dispatching the police to what could be a false alarm.

7.12 TRANSMIT DELAY

A. The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.

7.13 CALL WAITING CANCEL

A. The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.

7.14 CANCEL/VERIFY

A. The system shall be capable of sending either a Cancel Report or Verify Report to the Central Station to signify that the end user has Canceled an Alarm or Verified an Alarm condition. Also the system shall be programmable to instead of Cancel/Verify show “IS THIS A FALSE ALARM? NO YES”. If YES send validation of alarm to Central Station, if NO send alarm cancel.

PART 8 STANDARDS FOR FALSE ALARM REDUCTION

8.1 GENERAL

A. The system shall be capable of meeting ANSI/SIA CP-01-2010 Standards for False Alarm Reduction.

B. Exit Delay Standards
1. Default – 60 seconds (Minimum 45 seconds)
2. Progress Annunciation – different sound last ten seconds of delay
3. Automatic Restart of running exit delay, one time upon re-entry
4. Recent Closing – signal sent if alarm within 2 minutes of Exit time expiration (change from 5 min)
5. Exit Error – Immediate local alarm and entry delay starts

C. Entry Delay Standards

1. Default – 30 seconds (Minimum 30 seconds)
2. Pre-Warning Silenced – after first digit code entry
3. Cancel Message sent if disarmed after alarm sent

D. Fail-to-Exit Standards
1. When perimeter and exterior areas are defined and the user does not leave the building before the system arms, the system only arms the perimeter and leaves the interior unarmed.

E. Automatic Restart Standards
1. The system shall stop the Exit countdown once and restart it to allow the user to pick up a forgotten jacket or briefcase and exit the building without sending an alarm to the central station.

PART 9 BURGLARY CONTROL SPECIFICATIONS:

9.1 BURGLARY STANDARDS

A. The Burglary system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Burglary Listings	Canadian Burglary Listings
UL 1023 Household Burglar Alarm System Units	ULC C1023 Household Burglar Alarm System Units
UL 1076 Proprietary Burglar	ULC/ORD-C1076 Proprietary Burglar
UL 1610 Central Station Burglar Alarm Units	ULC S304 Central Station Burglar Alarm Units
UL 1635 Digital Burglar Alarm Communicator System Units	
U.S. Government Standards	
Meets ICD 705 Chapter 7 Intrusion Detection Systems (IDS)	
Meets DoD/NIST SCIF Standards	
Meets ANSI/SIA CP-01-2010 False Alarm Reduction	

9.2 AREA SYSTEM MODE

A. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a thirty-two (32) character length name programmed for each area.

B. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.

C. The networked system shall have the ability to comply with Bank Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.

D. The Encrypted system shall have the feature of Card Plus Pin by area High security card access is provided by the Card Plus Pin feature that requires both a card read and a PIN (4-6 digit user ID) entry for arming/disarming and access by area. This Card Plus Pin operation complies with the ICPG 705 requirement for dual id authentication and operates with a DMP Prox Keypad and a HID ProxPro reader with the keypad connected to a DMP Wiegand Interface module.

E. AISD standard configuration includes two (2) separate alarm areas:
1. Kitchen
2. School Perimeter Entry/Exit Doors

F. Coordinate final alarm area configuration programming with AISD owner representative prior to final testing and checkout.

G. Program all areas of intrusion system to Auto-Arm at 11:00 PM every night.

9.3 ALL/PERIMETER MODE

A. The system shall be capable of being configured into the All/Perimeter configuration to enable the selective arming of both the interior and perimeter when armed “All” or arming just the perimeter devices if arming “Perimeter”.

9.4 ZONES

A. The system shall have a minimum of eight (8) grounded burglary zones available from the control panel, and two floating ground powered zones for two wire type compatible smoke detectors. The system shall have the ability to expand using the panel’s keypad bus for up to sixty-four additional zones. The system shall also have five built-in zone expansion bus (LX500 – LX900) for an additional 500 zones of expansion. The system shall have the ability to integrate up to 500 wireless zones for a total of 574 zones overall.

9.5 BURGLARY EQUIPMENT

A. Burglary detection equipment shall communicate to the system by way of the control panel loop expansion bus or 900MHz bi-directional spread spectrum receiver. The detection equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in this document.

PART 10 COMPILED DETECTION EQUIPMENT LISTING

10.1 HARD-WIRED

A. Hard-wired detection equipment shall communicate to the system by way of the control panel loop expansion bus. The equipment shall have a one (1) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
1. Bus Splitter/Repeater Module – DMP Model 710
2. Addressable – DMP Model 711
3. Door Contact – 180-12-B or equal (requires DMP zone expander)
4. Door Magnet – 1840N or equal

5. Motion Detector – Visonic DUO240-E 360-degree ceiling or equal (requires DMP 711 zone expander)
6. Motion Detector – Bosch DS860 or equal (requires 711 zone expander)
7. Alarm Siren – DMP 335 siren or equal
8. Other third-party product types shall connect directly to zone expansion modules such as:
   a. Addressable – DMP Model 711
9. Cabling – Use only Southwire H91602 Composite Cable.

B. See Drawings for device locations and quantities.

10.2 CELLULAR COMMUNICATIONS EQUIPMENT

A. Cellular Communications equipment shall plug directly into the XR550 PCB J24 connector and shall be supervised by the XR550 control panel. The Cellular Communications Equipment shall be of a low current draw and powered directly by the XR550 Control Communicator.

B. The Cellular Communicator shall communicate in the SDLC Serial 3 Format for communications directly to a SCS-1R or SCS-VR DMP Central Station Receiver. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
1. 263C CDMA Digital Cellular Communicator
2. 381-2 18” Coax Cable

PART 11 INSTALLATION

11.1 SYSTEM COMPONENT INSTALLATION

A. Materials shall be installed in strict compliance with all local, state, county, province, district, federal and other applicable building, safety, and fire standards, laws, codes, regulations, and guidelines including, but not limited to, all appendices and amendments and the requirements of the local authority having jurisdiction (AHJ).

B. Addressable devices must be located as close to detection field sensor as possible.

C. 711 Addressable Zone Module to be mounted to electrical box directly above or near detection field sensor. Electrical box and/or conduit rough-in to be furnished and installed by Division 26 Electrical Contractor.

D. Clear label with black lettering “DMP + device address number” on ceiling grid below device location.

11.2 LIGHTNING SUPPRESSION

A. The system shall include an optional lightning suppressor module that intercepts and directs lightning, transient, and RF interference to ground.

11.3 WIRING

A. Use only wiring for LX-Bus and Keypad Bus to connect detection devices to XR550 control panel using DMP Model 711 zone expansion modules.

1. When planning an LX-Bus and keypad bus installation, keep in mind if these installation specifications are not met, the DMP bus may not perform to is full potential. Factors such as capacitance (because of too many devices) round the data waveform on the wire and impair communication. A wire run that is too long may not perform correctly because the long wire adds too much resistance and decreases the signal strength. Also, because of wire resistance and the number of devices, power input voltages at the device may be lower than an appropriate level to operate properly. As wire distance from the panel increases, DC voltage on the wire decreases.
2. Several factors must be considered to provide optimum bus operation:
    a. Use 18/4 or 22/4 unshielded wire, in the form of Southwire H91602 Composite Cable.
    b. Be sure the voltage at each device is above 11.8 VDC.
    c. Properly ground the system.
    d. Avoid running wires in noisy environments and underground.
    e. Add power supplies and 710/710F Modules for long runs and multiple devices.
    f. Use 708 Modules to increase bus performance on long line runs or in noisy environments.

B. On keypad bus circuits, to maintain auxiliary power integrity when using 22 AWG wire, do not exceed 500 feet. When using 18 AWG do not exceed 1,000 feet. Maximum number of LX-Bus devices per 2,500 foot circuit is 40. On XR500 Series panels only, when using the on-board LX-Bus (J22), the maximum number of LX-Bus devices on the first 2,500 feet circuit is 25. Refer to the XR500 Series Installation Guide (LT-0681), LX-Bus (J22) Expansion Connector section.

C. Wiring System Grounding: Connect a 14 AWG or larger wire from the panel terminal 4 to a good Earth ground. DMP recommends connecting to a cold water pipe ground, building ground, or a ground rod. Do not connect to an electrical ground, conduit, sprinkler or gas pipes, or to a telephone company ground.

D. Primary power for DMP panel must be plugged into power conditioner/voltage regulator on IT server rack.

END OF SECTION

SECTION 28 46 00 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

A. Design and Provide a complete new fire alarm system for the new elementary school facility.
   1. Protected premises shall consist of main building and all outbuildings where fire alarm coverage is required.

B. Fire alarm system shall incorporate Emergency Voice Alarm and Communication System (EVACS) style notification.

C. Section Includes:
   1. Fire Alarm System Delegated Design
   2. Fire Alarm System Installation, including all components, wiring, and conduit.
   3. Transmitters for communication with supervising station.
   4. Maintenance of fire alarm system under contract for specified warranty period.

1.2 DEFINITIONS

A. AHJ: Authority (or Authorities) Having Jurisdiction.

B. EMT: Electrical Metallic Tubing, a type of electrical conduit as defined in NFPA 70 article 358.

C. EVACS: Emergency Voice Alarm Communication System as defined in NFPA 72, also known as "Voice Evacuation".

D. FAA: Fire Alarm System Annunciator

E. FACP: Fire Alarm Control Panel

F. FPP: Licensed Fire Alarm Planning Professional.

G. HVAC: Heating, Ventilating, and Air-Conditioning

H. NICET: National Institute for Certification in Engineering Technologies

I. UON: Unless Otherwise Noted

1.3 REFERENCE STANDARDS

Standards referenced below shall be current edition including all revisions, UON.

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. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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

F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

J. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

K. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

L. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

M. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

N. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

1.4 ACTION SUBMITTALS

A. Delegated Design Submittal: Contractor shall perform all planning, calculations, etc. necessary for a complete fire alarm design, and prepare and submit to Authority Having Jurisdiction all documentation required for plan review and permitting, including but not limited to floor plans, riser diagrams, and description of operation.

B. Qualifications and Product Data:
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. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
4. Evidence of designer qualifications.
5. Evidence of installer qualifications.
6. Evidence of instructor qualifications; training lesson plan outline.
7. Evidence of maintenance contractor qualifications, if different from installer.

C. Shop Drawings and Design Calculations:
1. Shop drawing submittal shall be approved by AHJ prior to submission to Architect & Engineer.
2. 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.
3. System zone boundaries and interfaces to fire safety systems.
4. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.

5. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
6. List of all devices on each signaling line circuit, with spare capacity indicated.
7. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.

1.5 CLOSEOUT SUBMITTALS

A. 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.

B. Operating and Maintenance Data: See Section 01 78 00 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.

C. Project Record Documents: 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.

D. 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.
3. Maintenance contract.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
2. In addition to the items in quantities indicated in PART 2, furnish the following:

a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
b. One copy, on USB Flash Media, of all software not resident in read-only-memory.
c. Spare Lamps for Remote Indicating Lamp units: One unit, or 5% of the quantity of remote indicating lamp units installed, whichever is greater.
d. Spare Lamps for Strobe Units: One unit, or 5% of the quantity of strobes and horn strobes installed, whichever is greater.
e. Extra Fuses: Two for each size of installed fuse; Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.7 QUALITY ASSURANCE

A. Designer (Fire Alarm Planning Professional) Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by installing Contractor.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.8 PROJECT CONDITIONS

A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

B. Coordinate the work of this section with the work of other sections, including sprinkler systems, elevators, HVAC systems, and security/door locking systems.

1.9 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

2.1 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:

1. Honeywell Security & Fire Solutions/Gamewell-FCI: www.gamewell-fci.com/#sle.

B. Initiating Devices and Notification Appliances:
1. Honeywell Security & Fire Solutions/Gamewell-FCI: www.gamewell-fci.com/#sle.
2. Honeywell Security & Fire Solutions/System Sensor: https://buildings.honeywell.com/us/en/brands/our-brands/system-sensor
3. Same manufacturer as control units.

C. No Substitutions except by written written approval from Owner and Engineer

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
1. Provide all components necessary for a fully operational system in accordance with AHJ-approved design, applicable prescriptive codes, and design notes on contract drawings.
2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the local authority having jurisdiction , which is the City of Iowa Colony.
   c. Applicable local codes.
   d. Contract Documents (drawings and specifications).
   e. NFPA 101.
   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.
3. Evacuation Alarm: Single smoke zone per building ; general evacuation of entire affected building.
   a. System shall be programmed such that each independent building on campus alarms and evacuates separately, to the extent permitted by code and AHJ.
4. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
5. Program notification zones and voice messages as directed by AHJ.
6. Fire Alarm Control Unit: New, located at maintenance / custodial receiving entry.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By remote supervising station.
2. Remote Supervising Station: UL-listed central station under contract to facility.
3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), VoIP.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B.
2. Signaling Line Circuits (SLC): Class B.
3. Notification Appliance Circuits (NAC): Class B.
4. Pathway Survivability: Level 0.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:

1. Primary: Dedicated branch circuits of the facility optional standby power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

2.3 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.
4. Elevator shut-down control circuits.

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. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.

C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers.
2. Smoke and Fire/Smoke Damper Actuators: Close dampers, shut down air handlers.

E. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 71 00.
2. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 33 23.

2.4 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: Digital, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Fire Alarm Control Panel (FACP):
1. Field-programmable, microprocessor-based, modular, power-limited design.
2. Software, programs, system database, event history, etc. shall be held in non-volatile system memory to retain information through failure of primary and secondary power supplies.

3. FACP shall include a real-time clock for time annotation of events.
4. FACP shall provide a minimum 500-event history log.
5. Complying with UL 864.
6. Display: Graphical LCD type.
7. Digital Alarm Communicator Transmitter (DACT):
    a. DACT shall be acceptable to the remote central station and comply with UL 632.
    b. Communicator shall monitor communication line status, conduct automatic self-tests and initiate a System Trouble signal if service is lost.
    c. Communicator shall provide local annunciation and display capabilities for local testing and troubleshooting.
    d. Secondary Power: Communicator shall be provided with integral rechargeable battery and automatic charger.
8. Network Communications:
    a. Provide network communications and accessories as needed for fire alarm system IP communication to central station according to fire alarm manufacturer's written requirements.
9. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
    a. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
10. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
    a. Batteries: Sealed lead calcium.
    b. Sufficient capacity to provide power for entire system upon loss of normal AC power for a period of 24 hours with 15 minutes of alarm signaling at end of this 24-hour period, as required by NFPA 72, Local Systems.

D. Remote Annunciator(s): at front administrative office entry.
1. Display and user interface located remotely from main control panel.
2. Signals annunciated and functions available at annunciator shall match those of FACP for alarm, including alarm / supervisory / trouble indications, acknowledging, silencing, resetting, and testing.
3. Each annunciator shall be provided with a remote microphone for manual EVACS announcements.

E. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Releasing Control Modules: Provide as indicated or as required for control of listed solenoids in releasing applications.
5. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
6. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.

F. 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: Only at attended locations as indicated on drawings.
   a. Spares: Provide 1 extra.
   b. Pull Station Local Alarm Cover: At each pull station, provide a factory-fabricated clear plastic cover with top hinge and integral, battery-powered local alarm. Lifting cover actuates alarm to discourage false-alarm operation of pull station. Safety Technology International #Stopper II series or equal.
3. Smoke Detectors & Detector Bases: In each storage room, covering paths of egress, and all other locations required per prescriptive code. Refer to prescriptive codes referenced for detailed requirements.
   a. Detectors shall be twist-lock mounted to a fixed base wiring module, allowing replacement of detector without disturbing permanent wiring.
   b. Comply with UL 268.
   c. Spares: Provide 1 spare or 5% of quantity installed, whichever is greater.
4. Duct Smoke Detectors: At air handling equipment > 2000 CFM as required by code.
   a. Detectors shall be twist-lock mounted to a fixed base wiring module and sampling enclosure, allowing replacement of detector without disturbing permanent wiring.
   b. Weatherproof Duct Housing Enclosure: NEMA EN 10250, type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC ducts.
   c. Sampling Tubes: Design as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
   d. Relay Fan Shutdown: Programmable relay rated to interrupt fan motor control unit.
   e. Comply with UL 268A.
   f. Spares: Provide 1 extra.
5. Heat Detectors & Detector Bases: In kitchens, break rooms, and other locations where fire detection is required but smoke detection is subject to a high probability of false alarms. See prescriptive codes referenced for detailed requirements.
   a. Detectors shall be combination-type, programmable to actuate by either fixed temperature or rate-of-rise unless otherwise indicated.
   b. Detectors shall be twist-lock mounted to a fixed base wiring module, allowing replacement of detector without disturbing permanent wiring.
   c. Comply with UL 521.
   d. Spares: Provide 1 spare or 5% of quantity installed, whichever is greater.

G. Notification Appliances:
1. Bells: At each fire protection sprinkler system entry. See prescriptive codes referenced for detailed requirements..
2. Horn/Strobes: In accordance with applicable prescriptive codes..
   a. Combination device meeting same specifications and requirements as individual devices described below.
   b. Spares: Provide 1 extra.
3. Horns: In accordance with applicable prescriptive codes..
   a. Voice notification appliances complying with UL 1480.
   b. Locate speakers for voice notification to meet the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
      1) High-range Units: 2 to 15 W
      2) Low-range Units: 1 to 2 W.
      3) Matching Transformers: Tap range matched to acoustical environment of speaker location.
   c. Spares: Provide 1 extra.

4. Strobes: In accordance with applicable prescriptive codes..
   a. Xenon strobe lights complying with UL 1971.
   b. Rated light output: 15, 30, 75, or 110 cd, selectable in the field.
   c. Where wireguards or other protective covers are used, light output ratings required shall be calculated with guards in place.
   d. Flashing pattern shall be synchronized as prescribed in ADA Standards.
   e. Spares: Provide 1 extra.
5. Provide ceiling-mounted notification appliances except where ceilings are not present or noted on drawings to be free of devices. Refer to architectural plans for ceiling types, heights, and keep-out zones.
6. Provide wireguards in gyms and other areas where devices may be subject to physical damage.

H. Door Holders
1. Provide wall- or floor-mounted electromagnetic type hold-opens complete with matching doorplates as indicated on technology and/or architectural drawings and specifications.
2. Units shall require no more than 3 W to develop 25-lbf holding force.
3. Material and finish: match door hardware.

I. Remote Power Supply Units for Peripherals
1. Where required by the fire alarm system manufacturer, remote power supplies shall be provided that will provide sufficient current to drive audio/visual or other required devices.
2. These units shall be located in electrical closets, mechanical rooms or similar spaces. They shall not be installed in finished areas, storage rooms, etc., without the permission of the Engineer. All locations shall be indicated on the shop drawing submissions.
3. Remote power supplies shall be provided with local intelligence compatible with the digital multiplex network, so they have a unique address, providing the ability to monitor the supply for loss of power, shorts, grounds an d other supervisory functions.
4. Provide dedicated 120-volt power circuit(s) from nearby panelboards as required, whether indicated on the plans or not.

J. Circuit Conductors: Copper or optical fiber; color code and label.
1. Interconnection cabling between buildings shall be optical fiber. No exceptions.
2. Provide plenum cable in environmental air spaces, including plenum ceilings.

K. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.

L. Locks and Keys: Deliver keys to Owner.

M. 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 and/or annunciator 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

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
   1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

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

3.2 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer’s instructions.

C. Handling: Protect materials from damage during handling and installation.

3.3 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, AHJ requirements, and Contract Documents.

B. Pathways:
   1. Cabling concealed above lay-in & other accessible ceilings and in non-accessible exposed locations may be installed exposed.
      a. Provide plenum-rated cable for exposed cabling pathways routed through environmental air spaces, including plenum ceilings.
      b. For exposed pathways where cabling is 'accessible' (located less than 96 inches above the floor) or otherwise subject to physical damage, cabling shall be installed in EMT.
   2. Cabling other than exposed pathways as noted above shall be installed in EMT.
   3. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

D. Install manual fire-alarm box(es) in the normal path of egress within 60 inches of the exit doorway, between 42 inches and 48 inches above floor level.
   1. Provide "Stopper II" (or equal) covers on all manual stations except the manual station installed directly adjacent to the fire alarm control panel.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Install framed instructions in a location visible from fire-alarm control unit.

G. Grounding:

1. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
2. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.4 PARTIAL SEQUENCES OF OPERATION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual pull stations.
2. Smoke detectors.
   a. Provide UL-Listed alarm verification feature. Activate an approved "alarm verification" sequence at FACP and detector as prescribed by UL 864.
3. Heat detectors.
4. Automatic sprinkler system water flow.
5. Kitchen Hood fire suppression system.

B. Initiation of fire alarm signal shall automatically perform the following actions:
1. Annunciate alarm condition and specific initiating device addressable point at FACP and FAA(s).
2. Sound a distinctive evacuation signal throughout the zone(s) in alarm in accordance with NFPA 72 public mode alarm prescriptive requirements.
3. Activate flashing visual strobe alarm assemblies in accordance with NFPA 72 public mode alarm prescriptive requirements.
4. Transmit alarm message to remote supervising station in accordance with NFPA 72.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch(es).
2. Duct smoke detectors.
3. User disabling of zones or individual devices.
4. Loss of communication with any panel on the network.

D. Trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at FACP.
5. Break in standby battery circuitry
6. Failure of battery charging.
7. Abnormal position of any switch at FACP or annunciator.
8. Voice signal amplifier failure.

E. Initiation of supervisory or trouble signal shall automatically perform the following actions:
1. Annunciate supervisory or trouble condition and specific addressable point(s) at FACP and FAA(s).
2. Sound a distinctive audio alert at panel and annunciator locations.
3. After a time delay of 200 seconds, transmit a supervisory or trouble signal to remote supervising station in accordance with NFPA 72.

3.5 INSPECTION AND TESTING FOR COMPLETION

A. Field tests shall be witnessed by Authority Having Jurisdiction. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

D. Provide all tools, software, and supplies required to accomplish inspection and testing.

E. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
      b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

G. Prepare test and inspection reports.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Contractor furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session post-occupancy.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session post-occupancy.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.7 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

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.

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.

3.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

D. Installer shall provide a backup copy of the installed program database on USB drive upon completion of the project. They shall also provide the current version for the panel provided.

END OF SECTION

SECTION 31 00 00 – SITE EARTHWORK

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Operations required for the excavation and placement of materials on site.
   1. Operations required for the excavation of borrow material from approved sources.
   2. Compaction of natural subgrades.
   3. Placement and compaction of embankments to grade.
   4. Finish grading.
   5. Disposal of excess or unsuitable materials.
   6. Other required operations.
   7. Earthwork must conform with dimensions and typical sections shown, and within lines and grades established on the Drawings.

B. The Contractor shall inform and satisfy himself as to character, quantity and distribution of material to be excavated.

C. Work in this Section covers all site work not under proposed building slabs, mechanical equipment, or other specialized areas requiring a structural slab. Civil site work begins 5' outside the limits of proposed building slabs.

1.2 EXISTING UTILITIES

A. The plans show the approximate location of all known underground utility lines and structures. Where pipes, ducts and other structures are encountered in the excavation but are not shown on the plans, immediately notify the Owner's Representative.

1.3 CLASSIFICATIONS

A. Top Soil: Top 6 inches of natural surface soil possessing the characteristics of representative soils on the site that produce growths of grass or other vegetation. Topsoil includes grasses and other vegetation.

B. Subgrade: Consists of that portion of the surface on which a compacted embankment or pavement is constructed.

C. Compacted Embankment: Earth fill placed and compacted between subgrade and underside of pavement and fill areas adjacent to paving.

D. Borrow: Material taken from approved sources to make up any deficit of excavated material. The borrow shall have a measured plasticity index of between 7 and 20, and shall be free of organic matter and excess silt.

E. Finish Grading: Operations required for smoothing disturbed areas that are not overlaid with pavement.

F. Stripping of Ground Surface: All vegetation, all decayed vegetable matter, rubbish and other unsuitable material within the areas to be graded not removed by clearing shall be stripped or otherwise removed to ground level before grading or other earthwork is started. In no case will such material be allowed to remain in or on the areas to be graded.

G. Excavation: After all necessary stripping has been done, excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings.

H. Compaction: Compaction of soil materials shall be measured as a percentage of Standard Proctor density as determined by the AASHTO Standard T 99 procedure.

PART 2 P R O D U C T S

2.1 EQUIPMENT

A. Furnish, operate and maintain such equipment as is necessary to produce uniform layers, section and smoothness of grade for compaction and drainage.

B. Tamping Rollers:
1. Use tamping rollers with one or more cylindrical drums. Each cylinder must be at least 48 inches long and 40 inches in diameter.
2. The minimum weight per linear foot of drum length must be 1500 pounds weighted and 1000 pounds empty.
3. For tamping rollers with multiple cylinders, each cylinder must rotate independently and the cylinders must be pivoted on the main frame so that the units can adapt to irregularities in the ground surface.
4. Provide approximately 2.7 tamping feet per square foot of drum surface on each cylinder. Stagger the feet uniformly over the cylinder surface. Each foot should have a face area between 5 and 7 square inches and a clear projection from the cylinder surface of 7 to 9 inches. Equip each unit with a device for cleaning the feet as the cylinders rotate.
5. Use a crawler tractor with sufficient power to pull the tamping roller at a speed of approximately 3.0 miles per hour.

C. Rubber Tire Rollers:
1. Use rubber tire rollers having two axles and not less than a total of nine wheels with pneumatic tires.
2. Mount the wheels so that the rear tires will not follow in the tracks of the forward tires and so the unit will give uniform compaction over the entire width of coverage.
3. Mount the axles in a rigid frame with a loading platform or body suitable for being ballasted to a specified gross weight between 10 and 50 tons loading. The Owner's Representative will specify the tire inflation and gross weight.
4. If the roller is not self propelled, the towing equipment must also have pneumatic tires.

D. Use tank trucks, pressure distributors or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths.

E. Scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment and other equipment must be suitable for construction of fills.

2.2 EARTH FILL

A. Obtain embankment fill from required excavation or, if excavated material is not sufficient, from Borrow areas approved by the Owner's Representative.

B. Use the best material available from excavation or borrow. Suitability of fill material is subject to the approval of the Owner's Representative.

C. Fill material must be free of excessive silts. Do not use soil containing brush, roots, sod or similar perishable material.

D. Embankment material must have a plasticity index between 7 and 20 inclusive.

PART 3 E X E C U T I O N

3.1 REMOVAL OF TOPSOIL

A. Remove topsoil within the limits of the construction areas as shown on the Drawings.

B. Stockpile acceptable existing topsoil for future distribution. Protect stockpiled topsoil from other excavated materials. Contractor shall have existing topsoil tested for compliance with Division 32. Non-conforming topsoil shall be removed and disposed of off-site.

3.2 EXCAVATION

A. As shown on the Drawings, excavate to lines, grades and elevations required for subsequent construction of embankments or pavement. Remove materials within the indicated limits and dispose of as directed.

B. Maintain grades during excavation for complete drainage. When required, install temporary drains or drainage ditches to intercept or divert surface water and prevent interference or delay of the Work.

C. If at time of excavation it is not possible to place material in the proper section of permanent construction, stockpile the material in approved areas for later use.

D. Stones or rock fragments larger than 2 inches in their greatest dimension will not be permitted in top 6 inches of subgrade.

E. Uniformly dress cut and fill slopes to grade, cross section and alignment, as shown.

3.3 SUBGRADE UNDER PAVEMENTS

A. After excavation is made to subgrade lines under proposed pavements, remove and replace soft or undesirable material with select material as specified for embankments. Stabilize and compact the subgrade as stated in the sections on stabilization of pavement subgrade.

3.4 TREATMENT OF NATURAL SUBGRADE UNDER EMBANKMENTS

A. After excavation is made to lines under proposed embankments, remove soft or undesirable material to a depth determined by the Owner's Representative. Break down sides or holes or depressions to flatten the slopes.

B. Fill each depression with the appropriate soil for the materials to be placed on the subgrade. Place the fill in layers moistened and compacted as specified in this section.

C. After depressions have been filled and immediately before placement of compacted fill in a section of the embankment, thoroughly loosen the foundation material to a depth of 6 inches. Remove roots and debris turned up while loosening the soil.

D. Compact the surface of the embankment subgrade as specified in the following paragraphs.

E. Take care to prepare the embankment so that planes of seepage or weakness are not induced. Should the Owner's Representative suspect such a deficiency, the material must be thoroughly broken and recompacted before proceeding with construction.

3.5 PLACING EMBANKMENT FILL

A. Do not place fill on any part of the embankment subgrade until the subgrade preparation has been inspected by the Owner's Representative.

B. During the dumping and spreading process, remove all roots, stones and debris that are uncovered in the embankment material.

C. After dumping, spread the material in horizontal layers over the entire fill area. The thickness of each layer before compaction must not exceed 8 inches unless otherwise directed. As soon as possible after placement begins, crown the surface to drain freely and maintain such conditions throughout construction.

D. If the compacted surface of a layer is too smooth to bond with succeeding layers, loosen the surface by harrowing or other approved method before continuing the work.

E. Stabilize and compact the top of embankment fills under pavement sections as specified in the section on stabilization of pavement subgrade, construction plans, and Geotechnical Report.

3.6 MOISTURE CONTROL

A. Developing the maximum density obtainable with the natural moisture of the embankment material is preferred. However, the moisture content must be 1 to 3 percentage points wet of optimum, as determined by AASHTO Test Method T 99.

B. If the moisture content is too high, adjust to within the specified limits by spreading the material and permitting it to dry. Assist the drying process by discing or harrowing if necessary. When the material is too dry, sprinkle each layer with water. Work the moisture into the soil by harrowing or other approved method.

3.7 COMPACTION

A. Compact each layer of embankment with suitable rollers as necessary to secure at least 95% of the standard Proctor density, within the specified range of the moisture content, according to AASHTO Test Method T 99.

3.8 DISTRIBUTION OF TOPSOIL

A. Preparation:
   1. Prior to placing topsoil, scarify the subgrade to a depth of 2 inches to provide effective bonding of the topsoil with the subgrade. Use a chisel plow with the chisels set 10 inches apart.
   2. Shape all areas designated for grading, including cut and fill areas, to receive a minimum of 4 inches of topsoil.
   3. In areas that require only blading and dressing, the adequacy of existing topsoil will be determined by the Owner's Representative.

B. Placement:
   1. Do not haul or place wet topsoil. Also prohibited is placement of topsoil on a subgrade that is excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or proposed planting.
   2. Distribute topsoil uniformly and spread evenly to an average thickness of 4 inches. Do no compact topsoil. Correct irregularities in the surface to prevent formation of depressions where water could stand.
   3. Perform the spreading operation so that planting can proceed with little additional tillage or soil preparation. Leave the area smooth and suitable for lawn planting.

C. Where any portion of the surface becomes eroded or otherwise damaged, repair the affected area to establish the condition and grade prior to topsoil placement. Replace topsoil.

3.9 MATERIAL DISPOSAL

A. Remove excess excavated material and excess topsoil from the area before substantial completion. Stockpile materials separately in designated areas. Excess soil, topsoil and strippings shall become property of the Contractor and shall be removed from the site.

B. Dispose of waste material without causing expense or damage to the Owner.

END OF SECTION

SECTION 31 06 20.15 - CEMENT STABILIZED SAND

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Cement stabilized sand.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C 150 - Specification for Portland Cement.

H. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil Cement-Mixtures.

I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.

J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

K. ASTM D 2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

M. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.

N. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.3, Materials Qualifications.

1.5 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.
   1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
   2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Division 2 and the following requirements:
   1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.
   2. Deleterious materials:
      a. Clay lumps, ASTM C 142 - less than 0.5 percent.
      b. Lightweight pieces, ASTM C 123; less than 5.0 percent.
      c. Organic impurities, ASTM C 40, color no darker than standard color.
   3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.2 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.3 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:
   1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.
   2. Complete molding of samples within 4 hours after addition of water.
   3. Perform strength tests (average of two specimens) at 48 hours and 7 days.
   4. Perform cement content tests on each sample.
   5. Perform moisture content tests on each sample.
   6. Plot average 48-hour strength vs. cement content.
   7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test raw sand for following properties at point of entry into pug-mill:
   1. Gradation
   2. Plasticity index
   3. Organic impurities
   4. Clay lumps and friable particles
   5. Lightweight pieces
   6. Moisture content
   7. Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:
   1. f'c% 1/2 standard deviation

PART 3 E X E C U T I O N

3.1 PLACING

A. Place sand-cement mixture in maximum 8-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is +/- 3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

C. Where water lines cross wastewater lines, embed wastewater line with cement stabilized sand in accordance with Texas Administrative Code 290.44(e)(4)(B):
   1. Provide minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume. Use at least 2.5 bags of cement per cubic yard of mixture (2 sacks per ton of dry sand).
   2. Unless otherwise shown on the Drawings, embed wastewater main a minimum of six inches above and below.

3.2 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number
2. Time material was batched
3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number
8. Indication of compliance / non-compliance
9. Mixture identification 3
10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.3 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:
   1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
   2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength tests (average of two specimens) have 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Owner's Representative, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.3.A.

G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.4 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:
   1. Credit per Cubic Yard = $30.00 x 2 (100 psi - Actual psi) 100

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to Owner.

END OF SECTION

SECTION 31 06 20.17 - UTILITY BACKFILL MATERIALS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:
1. Concrete sand
2. Gem sand
3. Pea gravel
4. Crushed stone
5. Crushed concrete
6. Bank run sand
7. Select backfill
8. Random backfill

C. Material Handling and Quality Control Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

A. Unsuitable Material:
1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.
4. Materials contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material:
1. Materials meeting specification requirements.
2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.

G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.

H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Division 33 for other definitions regarding utility installation by trench construction.

1.4 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregate.

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.

E. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Standard Test Method for Amount of Material in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. ASTM D 4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.

K. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

L. TxDOT Tex-460-A - Material Finer Than 75 Fm (No.200) Sieve In Mineral Aggregates (Decantation Test for Concrete Aggregates).

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.3, Material Testing.

D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.

E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

1.6 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.3B.

B. Verification tests of backfill materials may be performed by Owner in accordance with Division 1.

C. Random fill obtained from the project excavation as a source is exempt from prequalification requirements by the Contractor but must be inspected and tested by the Geotechnical Testing Lab prior to use to insure material meets specifications.

PART 2 P R O D U C T S

2.1 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.1B, or by product descriptions, as given in Paragraph 2.2.

B. Class Designations Based on Laboratory Testing:
   1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
      a. Plasticity index: non-plastic.
      b. Gradation: D_{60}/D_{10} - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
   2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
      a. Plasticity index: non-plastic to 4.
      b. Gradations:
         1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
         2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
         3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.
   3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
      a. Plasticity index: greater than 7.
      b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
   4. Class IVA: Lean clays (CL):
      a. Plasticity Indexes:
         1) Plasticity index: greater than 7, and above A line.
         2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
      b. Liquid limit: less than 50.
      c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
      d. Inorganic.
   5. Class IVB: Fat clays (CH):
      a. Plasticity index: above A line.
      b. Liquid limit: 50 or greater.
      c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
      d. Inorganic.
   6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

2.2 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by Owner's Representative. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Division 31.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:
   1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
   2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
   3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Owner's Representative, provided that physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:
   1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
   2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing

1/2”	100
3/8”	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:
1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by Owner’s Representative.
2. Non-plastic fines.
3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.
5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment By Ranges of Nominal Pipes Sizes		
	>15”	15” – 8”	< 8”
1”	95 – 100	100	--
¾”	60 – 90	90 – 100	100
½”	25 – 60	--	90 – 100
3/8”	--	20 – 55	40 – 70
No. 4	0 – 5	0 – 10	0 – 15
No. 8	--	0 – 5	0 – 5

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Division 31 to meet plasticity criteria.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Division 31.

K. Cement Stabilized Sand: Conform to requirements of Division 31.

L. Concrete Backfill: Conform to Class B concrete as specified in Division 32.

2.3 MATERIAL TESTING

A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source

characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:

1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.
2. Plasticity of material passing No. 40 sieve.
3. Los Angeles abrasion wear of material retained on No. 4 sieve.
4. Clay lumps.
5. Lightweight pieces.
6. Organic impurities.

B. Production Testing. Provide reports to Owner's Representative from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.

C. Assist Owner's Representative in obtaining material samples for verification testing at source or at production plant.

PART 3 E X E C U T I O N

3.1 SOURCES

A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied. If on-site excavated materials are not acceptable for use as backfill, the Contractor shall provide from another source at no additional cost to the owner.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Owner's Representative may obtain samples for verification testing.

C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Owner's Representative, expense for sampling and testing required to change to different material will be at the cost of the Contractor.

D. Bank run sand, select backfill and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete work from off-site sources.

E. Owner does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.

3.2 MATERIAL HANDLING

A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.

B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Owner's Representative in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.3 FIELD QUALITY CONTROL

A. Quality Control
   1. The Owner’s Representative may sample and test backfill at:
      a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
      b. On-site stockpiles.
      c. Materials placed in Work.
   2. The Owner’s Representative may re-sample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: Owner's testing laboratory will provide verification testing on backfill materials, as directed by Owner’s Representative. Samples may be taken at source or at production plant, as applicable.

END OF SECTION

SECTION 31 11 00 - CLEARING AND GRUBBING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removing surface debris and rubbish.

B. Clearing site of plant life and grass.

C. Removing trees and shrubs.

D. Removing root system of trees and shrubs.

E. Fence removal.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate clearing work with utility companies.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.2 PROTECTION

A. Protect following from damage or displacement:
   1. Plants, trees and landscape features designated to remain.
   2. Utilities designated to remain.
   3. Bench marks, monuments, and existing structures designated to remain.

3.3 CLEARING

A. Remove stumps, main root ball, and root system to:
   1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.
   2. Depth of 24 inches below finished surface of required cross section for other areas.
   3. Backfill and compact excavations with suitable backfill material as described in Division 31.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse.

D. Where clearing and grubbing has been performed in advance by others, Contractor shall perform such additional clearing and grubbing in the manner describe herein as required for

the construction of the facilities as described in this Contract at no additional cost to the Owner.

3.4 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Division 1.

B. Remove on site fences as shown on plans including buried concrete bases as required. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

SECTION 31 22 00 – SITE GRADING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures, building pads, and play fields.

C. Replacement of topsoil and finish grading for planting.

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.

1.3 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

B. For sites located in the 100-year Floodplain, the Contractor shall provide an As-Built Survey of all work (cut or fill) located within the 100-year Floodplain. Survey shall be signed and sealed by a Registered Land Surveyor and be on the same survey datum as the design drawings.

1.4 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.

B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

C. Protect survey bench marks and control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Topsoil - Soil Type: Topsoil excavated on-site.
   1. Graded.
      a. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
      b. Provide imported topsoil conforming to the requirements of Division 32 as required.
      c. On-site topsoil may be used. Contractor shall have on-site topsoil test and analyzed for compliance with Division 32. It is the Contractor’s responsibility to add approved imported topsoil as required to achieve grades and specified depth at no additional cost to the Owner.
   2. Other Fill Materials: Reference relevant sections of Division 32 and the Drawings.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, leveler contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage. Damage to existing drainage structures will be corrected by Contractor at no additional cost to the Owner.

D. Notify utility company to remove and relocate utilities.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Division 31 Specifications for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site, pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove/Break-up soil clumps greater than 1” in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

E. Place topsoil in areas where seeding is indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil to the following compacted thicknesses:
   1. Areas to be seeded with Grass: 4 inches (150 mm).
   2. Areas to be sodded: 4 inches (100 mm).

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Near plants spread topsoil manually to prevent damage.

K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

L. Lightly compact placed topsoil.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

C. When grading drainage areas to drainage structures (inlets), the area must have a uniform slope to drainage structure. Steep drop-offs into drainage structures will not be allowed.

3.7 FIELD QUALITY CONTROL

A. See Division 1 and Division 31 for compaction density testing.

B. Contractor shall coordinate site inspection with Owner/Architect/Engineer prior to placement of final topsoil and landscape materials.

3.8 CLEANING AND PROTECTION

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water. Excess topsoil and subsoil to be removed at no additional cost to Owner.

B. Leave site clean and raked, and ready to receive landscaping.

END OF SECTION

SECTION 31 22 16 - FINE GRADING

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 the work specified in this section.

1.2 RELATED SECTIONS

A. Turf and Grasses: Section 32 92 00
B. Topsoil: Section 32 22 17

1.3 SCOPE

A. Machinery restrictions
B. Site preparation for grass areas
C. Finished grading
D. Prevention of excessive weed growth in lawns

PART 2 – PRODUCTS

2.1 TOPSOIL

A. Topsoil for all fine grading operations shall be classified as “Enriched Top Soil” made from sandy loam with organic compost, free of debris or any vegetative matter.

1. Living Earth Technology, Houston, Texas (713)466-7360 5802 Crawford Road, Houston, Texas 77041
2. Nature’s Way Resource, Conroe, Texas (936)321-1200 101 Sherbrook Circle, Conroe, Texas 77385
3. The Ground Up, Houston, Texas (281)970-0003 9945 Windfern Road, Houston, Texas 77064

B. If topsoil from the existing site excavation and striping is available and can be utilized, topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics (Ref Section 322217 for additional information):

1. pH value of between 5.5 and 6.5
2. Liquid limit: 50 or less
3. Plasticity index: 20 or less.
4. Gradation: maximum of 10 percent passing the No. 200 sieve.

2.2 SUBMITTALS

A. Contractor shall submit small bag of soil sample to landscape architect for approval prior to deliver material to site.

PART 3 - EXECUTION

3.1 GENERAL

A. Finished grading shall be defined as placing and grading of additional soil (topsoil 2” minimum) required bringing the grade to the required grades for lawns. As well as smooth out rough areas. Where practical and as directed, the use of heavy machinery shall be kept to a minimum.

3.2 PLACEMENT OF FINE GRADE MATERIALS

A. Clear the subgrade of stones larger than 3 inches (3") in any dimension, and of concrete, wood, construction debris, and other deleterious matter. Excavate to a depth of 12 inches (12") all areas that have become saturated with oil, gasoline or bituminous products and backfill with clean earth.
B. Import topsoil directly to site of deposition or stockpile new topsoil on site in quantity needed to produce the required depth after spreading. Protect topsoil piles from erosion with tarpaulins and limit boards.
C. Spread topsoil to a minimum settled depth of 2 to 3 inches and feather smoothly into finished grade at edges so as to blend with adjacent ground shapes.
D. Exercise precautions to keep the topsoil friable and porous. Do not handle or work topsoil when it is excessively wet, or during a rainfall. Do not place topsoil on any subgrade that has not been loosened or tilled or allowed for drainage. Loosen and till the full depth of the topsoil and re-till any areas that become unduly compacted by vehicular movement.

3.3 FINE GRADING

A. The Contractor shall be responsible for minor adjustments to the finished subgrade if such treatment is required in the opinion of the landscape architect.
B. Hand rake the surface, removing all clods and undesirable material greater than one half inch (1/2") from ground surface. Fill all low spots with specified materials and cut irregularities to the acceptance of the landscape architect.
C. An acceptable fine grade shall be free from depressions greater than 6 inches (6") over any given space of 25' except at grade transitions which shall be gradual and even.
D. During the finished grading operations, all swales and additional swales that may be required to drain areas shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water.
E. To prevent excessive weed growth in the lawn areas, the contractor should be prepared to immediately install the lawn upon the completed and acceptable finished grade.

3.4 CLEAN UP AND PROTECTION

A. After completion of fine grading and top soiling operations, do not drive trucks or other heavy equipment over finished areas.
B. Upon completion of the work, remove all debris and excess material from the site so that the area is left neat and clean.

END OF SECTION 31 22 16

SECTION 31 22 17 - TOPSOIL

PART 1 - GENERAL

1.1 SCOPE

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics:

1. pH value of between 5.5 and 6.5

2. Liquid limit: 50 or less

3. Plasticity index: 20 or less.

4. Gradation: maximum of 10 percent passing the No. 200 sieve.

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavation and embankment operations have been completed to correct lines and grades.

3.2 TOPSOIL EXCAVATION

A. Strip off topsoil from the area to be excavated to a minimum depth of 6 inches, unless indicated otherwise on the Drawings.

B. Stockpile topsoil in a designated location for reuse. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.3 PLACEMENT

A. For areas to be seeded or sodded, scarify or plow existing material to a minimum depth of 4 inches, or as indicated on the Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with an appropriate lawn roller to consolidate topsoil.

B. For areas to receive shrubs or trees, excavate existing material and place topsoil to the depth and dimensions shown on the Drawings.

3.4 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION 31 22 17

SECTION 31 23 15 – BUILDING EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Excavation, preparing of subgrade, and select fill installation for building foundations and exterior equipment slabs.
2. Excavating and backfilling of trenches within building lines and 5 ft. out.
3. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.
4. Disposal of removed materials not utilized in the Work.

B. Related Requirements:

1. Section 00 31 32 - Geotechnical Data.

1.2 SUBMITTALS

A. Test Reports: The independent testing laboratory shall submit the following reports directly to Architect/Engineer with copy to others as designated in accordance with the provisions of section 01 40 00 "Quality Control Services." State in each report whether or not the test specimens comply with the specified requirements, and indicate any deviations.

1. Test reports on soil material properties.
2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
3. Field reports; in-place soil density tests.
4. One optimum moisture-maximum density curve for each type of soil encountered.

B. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Architect/Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geo-technical testing without delaying the progress of the Work.

1.3 DEFINITIONS

A. Borrow consists of off-site material.

B. Excavation consists of removal of all materials encountered to over-excavate for replacement with select fill, and to obtain the required subgrade elevations indicated.

C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without

altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect/Engineer.

2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect/Engineer.

D. Additional Excavation: When excavation has reached required subgrade elevations, notify Architect/Engineer, who will make an inspection of conditions. If Architect/Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Architect/Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Removal of unsuitable material and its replacement, as directed, will be paid on basis of Conditions of the Contract relative to changes in Work.

E. Subgrade: The undisturbed earth or the compacted soil layer immediately below topsoil materials and down to the excavated level.

F. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation Work in compliance with applicable requirements of authorities having jurisdiction.

B. Soil properties: Test in accordance with the requirements of Part 2 - Products, article "Soil Materials."

1.5 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

B. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

C. Existing Utilities: Locate existing underground utilities in areas of excavation Work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect/Engineer and then only after acceptable temporary utility services have been provided.

3. Provide minimum of 48-hour notice to Architect/Engineer and receive written notice to proceed before interrupting any utility.
4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

D. Use of Explosives: Use of explosives is not permitted.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP, and meeting the requirements of the General Notes on the structural drawings.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

C. Backfill and Select Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Refer to the general notes on the drawings and project's geotechnical report for acceptable soil properties as determined by ASTM D4318.

D. Other Materials: All other materials not specifically described but required for the proper completion of the Work of this Section, shall be as selected by the Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

B. Earth Excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.

1. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered that cannot be dislodged and excavated with modern, track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping.
2. Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
3. Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

D. Do not perform rock excavation Work until material to be excavated has been cross-sectioned and classified by Architect/Engineer. Such excavation will be paid on basis of Contract Conditions relative to changes in Work.

3.2 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.Provide permanent steel sheet piling or pressure-creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.

3.3 DEWATERING

A. Prevent surface water and subsurface or groundwater 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 foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other 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 rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches. Do not allow water to stand near the foundation of any structure at any time.

3.4 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for site utility backfill, for chemically treated fill under paving, and for final lawn area grading where directed. Excavated materials shall not be utilized under building structures unless specifically approved by the Owner’s geotechnical laboratory. 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. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill as directed in PART 3 section: “DISPOSAL OF EXCESS AND WASTE MATERIALS”.

3.5 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.

1. Excavations for footings and foundations: Do not disturb bottom of excavation. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. When excavation exceeds five (5) foot in depth, the soil on all sides of the excavation shall be laid back at a slope not to exceed two (2) horizontal to one (1) vertical.
3. In cohesive materials, footing sides do not require formwork as long as the sides can be maintained in a neat and vertical manner, "mushrooming" will not be allowed. Provide forms if sides cannot be maintained or if the excavation is larger than footing design dimensions.

B. Removal of Unsatisfactory Soil Materials:

1. Strip the exposed soils within the proposed building and paving footprints and 5-ft. beyond to a depth of 6-inches. Vegetation, topsoil, debris, and other deleterious materials shall be removed during the initial stripping operations. Stockpile useable topsoil in an area on the site as approved by the Architect.

C. After removal and stockpiling of the upper 6 inches of topsoil, provide additional excavation as may be needed to achieve a depth of compacted select fill as noted below for each project. In this excavation, remove all soil, roots, organic material, fill material, and miscellaneous debris.

1. Remove and replace at least 12-inches supporting the slab-on-grade and extending a minimum of 3-feet beyond the building footprint.
2. Slope building fill from building perimeter as indicated on the drawings.

D. Where unsatisfactory materials are encountered that extend below the specified excavation depths, excavate to the required additional depths as directed by the Owner’s geotechnical engineer.

1. Such additional excavation, provided it is not due to the fault or neglect of the Contractor, will be measured as directed by the Architect/Engineer and paid for by the Owner as a change in the Work.
2. Where the removal of unsatisfactory soil materials, is due to the fault or negligence of the Contractor in his performance of earthwork and site grading operations, excavate the resulting unsatisfactory soil material and replace with compacted satisfactory soil material as required.
3. Proceed with additional soil removal requiring additional payment only with approval from the Architect and Owner.

E. Under direct observation by representatives of the Owner's testing laboratory, proof roll the exposed subgrade with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded tandem axle dump truck, to detect any wet, soft, unstable, loose, or weak zones in the upper 18-inches of subgrade after excavation.

1. When proof rolling areas containing fill soils, exercise special care in an attempt to observe soft and weak zones. Weak areas detected during proof rolling, as well as zones of fill containing organic matter and/or debris, shall be removed and replaced with compacted select fill.

2. Scarify and moisture condition the upper 6” of exposed subgrade and re-compact to 95% standard proctor density per ASTM D698 at a moisture content between optimum and plus 4%.

3.6 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit. When excavation exceeds five (5) foot in depth, the soil on all sides of the excavation shall be laid back at a slope not to exceed two (2) horizontal to one (1) vertical.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6 inch layer of crushed stone or gravel prior to installation of pipe.
2. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
3. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads. Ensure continuous bearing of pipe barrel on bearing surface.
4. To restrict water intrusion at utility trenches, provide a clay fill or Bentonite trench “plug” at piping as it crosses the building line. Place fully compacted clay plug to completely surround the utility line and fill the excavated trench for a distance of 5 ft. outside the building line and 5 ft. inside the building line.

3.7 COLD WEATHER PROTECTION

A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35^{o} F.

3.8 BACKFILL AND FILL

A. General: Place fill material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under building slabs, use select fill material.
2. Under steps, use subbase material.
3. Under piping and conduit and equipment, use subbase materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.
4. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
5. Concrete is specified in Division 3.
6. Do not backfill trenches until tests and inspections have been made and backfilling has been authorized by Architect/Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.9 PLACEMENT AND COMPACTION

A. Place backfill and select fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Compacted thickness of each layer not to exceed 6-inches.

B. 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. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

D. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated.

E. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557/698:

1. Under building structures, building slabs, steps, and outdoor mechanical equipment slabs, compact each layer of fill material at a minimum of 95-percent maximum density, and a maximum of 100 percent maximum density.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations. Acceptable moisture content shall be plus or minus 2% from optimum as determined by ASTM D 1557/698.
3. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
4. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.10 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material. Shape to line, grade, and cross section as shown on the drawings.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:

1. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10 foot straightedge.
2. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.11 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Independent testing laboratory shall inspect and approve each subgrade and fill layer before further backfill or construction work is performed. The testing laboratory will be responsible for verbally informing the Contractor of the test results immediately upon completion, so unnecessary delay is eliminated and unsatisfactory Work is not covered up. Continued progress of the Work shall not relieve the Contractor of the responsibility of complying with specification requirements.

1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.
2. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.

B. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect/Engineer.

1. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Architect/Engineer.

C. Building Slab Subgrade: Perform at least one field density test of subgrade per the frequency listed below, but in no case fewer than three tests. In each compacted fill layer, perform one field density test per the frequency listed below, but in no case fewer than three tests.

1. Structures and building slabs: 3,000 sq. ft.

D. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.

E. If in opinion of Architect/Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.12 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

B. Use all means necessary to control dust on and near the Work and on and near all off-site borrow areas if such dust is caused by the Contractor's operations during performance of the Work or if resulting from the condition in which the Contractor leaves the site.

C. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

3.13 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface, add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.14 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal to Designated Areas on Owner's Property: Transport acceptable excess excavated material to designated soil storage areas on Owner's property. Stockpile soil or spread as directed by Architect/Engineer.

1. Transport waste material, including unacceptable excavated material, trash, and debris to designated spoil areas on Owner's property and dispose of as directed.

B. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION 31 23 15

SECTION 31 23 16.14 - TRENCH SAFETY SYSTEM

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Trench Safety System for the construction of trench excavations.

B. Trench Safety System for structural excavations that fall under provisions of State and Federal trench safety laws.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 DEFINITIONS

A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

B. The Trench Safety System requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and the installation to dimensions equivalent of a trench as defined.

C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

D. Trench Safety Program is the safety procedures governing the presence and activities of individuals working in and around trench excavations.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Division 1.

B. Submit a safety program specifically for the construction of trench excavation. Design the Trench Safety Program to be in accordance with OSHA 29 CFR standards governing the presence and activities of individuals working in and around trench excavations.

C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by Contractor.

D. Review of the safety program by the Engineer will only be in regard to compliance with this specification and will not constitute approval by the Engineer nor relieve Contractor of obligations under State and Federal trench safety laws. The Engineer/Owner will not provide approvals or disapprovals of submittal but will retain for records.

1.5 REGULATORY REQUIREMENTS

A. Install and maintain Trench Safety Systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

B. The Contractor is responsible for obtaining a copy of OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209.

C. Legislation that has been enacted by the Texas Legislature with regard to trench safety systems is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., § 756.021 (Vernon 1991).

1.6 INDEMNIFICATION

A. Contractor shall indemnify and hold harmless the Owner, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.

B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Install and maintain Trench Safety Systems in accordance with provisions of OSHA 29 CFR.

B. Install specially designed Trench Safety Systems in accordance with the Contractor's trench excavation safety program for the locations and conditions identified in the program.

C. A competent person, as identified in the Contractor's trench safety program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

3.2 INSPECTION

A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the Trench Safety Systems to ensure that the installed systems and operations meet OSHA 29 CFR and other personnel protection regulations requirements.

B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until necessary precautions have been taken by Contractor to safeguard personnel entering the trench.

C. Maintain a permanent record of daily inspections.

3.3 FIELD QUALITY CONTROL

A. Contractor shall verify specific applicability of the selected or specially designed Trench Safety Systems to each field condition encountered on the project.

END OF SECTION

SECTION 31 23 33 – EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:
   1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
   2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
   3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
   4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Division 1.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.
   1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
   2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
      a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
      b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.
      c. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Division 31.

S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

1.4 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Particle Size Analysis of Soils.

L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.5 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.6 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit backfill material sources and product quality information in accordance with requirements of Division 31.

C. Submit trench excavation safety program in accordance with requirements of Division 31. Include designs for special shoring as required.

D. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

1.7 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by Owner in accordance with requirements of Division 1 and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Division 31.

1.8 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 P R O D U C T S

2.1 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.8, Special Shoring Design Requirements.

2.2 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Division 31.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Division 31.

C. Geotextile (Filter Fabric): Conform to requirements of Division 1.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.1 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

C. Classification of material will be determined by Owner's Representative.

3.2 PREPARATION

A. Establish traffic control to conform to requirements of Division 1. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Division 31.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Owner's Representative and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Division 2, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Division 1. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Division 1.

3.3 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2 feet vertically and 4 feet horizontally of proposed work.
   1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.
   2. Notify Owner's Representative in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Owner's Representative is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Owner's Representative with 48 hours notice prior to field excavation or related work.

3.4 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Division 1.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to the Owner.

3.5 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Minimum trench width shall be wide enough to allow for hand tamping of backfill material under haunch of pipe.

Nominal Pipe Size, Inches	**Minimum Trench Width, Inches**
12” and Less	O.D. + 18”
15” to 30”	O.D. + 24”
36” to 42”	O.D. + 36”
Greater than 42”	O.D. + 48”

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Owner’s Representative and obtain instructions before proceeding.

F. Shoring of Trench Walls.
1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.
2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Owner’s Representative. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.

G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:
1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.
3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.
5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by Pipeline Company’s representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 3 feet of Pipeline Company’s line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company’s representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy-acetylene weld is exposed, immediately notify Owner’s Representative. Provide supports for collar or welds. Discuss with Pipeline Company’s representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

3.6 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Division 31. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Division 31.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with

Division 1. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.7 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6 inches. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, if directed by Owner's Representative, in accordance with Paragraph 3.7B above. Removal of unstable or unsuitable material may be required if approved by Owner's Representative:
   1. Even though Contractor has not determined material to be unsuitable, or
   2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Division 1.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.8 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means. Backfill material shall be hand tamped under haunch of pipe to insure backfill material totally encases pipe.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted

areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water line construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Division 31. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:
   1. Class I, II and III Embedment Materials:
      a. Maximum 6 inches compacted lift thickness.
      b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
      c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Owner's Representative.
   2. Cement Stabilized Sand (where required for special installations):
      a. Maximum 6 inches compacted thickness.
      b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
      c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
   3. Class I Embedment Materials.
      a. Maximum 6-inches compacted lift thickness.
      b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
      c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.
   4. Class II Embedment and Cement Stabilized Sand.
      a. Maximum 6-inches compacted thickness.
      b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
      c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

K. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.9 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction and inspections.

B. For water lines, backfill in trench zone, including auger pits, intermediate and site pits, with bank run sand, select fill, or random backfill material as specified in Division 31.

C. For sewer pipes, use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand to level 12 inches below the pavement. For sewer pipes under natural ground backfill from 12 inches above top of pipe to 6" inches below finish grade with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt

pavements for 12- inch backfill directly under pavement. Use topsoil for 6-inch backfill directly under natural grade. For backfill materials reference Division 31.

D. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.

E. When shown on Drawings, random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

F. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.
   1. Class I, II, III or IV or combination thereof (Random Backfill):
      a. Maximum 8-inches compacted lift thickness.
      b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
      c. Moisture content within zero percent to +5 percent of optimum determined according to ASTM D 698, unless otherwise approved by Owner's Representative.
   2. Cement-Stabilized Sand:
      a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.
      b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
      c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.
   3. Select Backfill:
      a. Place in maximum 8-inch loose layers.
      b. Compaction by equipment providing tamping or kneading impact to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
      c. Moisture content within 2 percent below or 5 percent above optimum determined according to ASTM D 698, unless approved by Owner's Representative.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone.
   1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at no additional cost to Owner, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.
   2. Maximum 8-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
   3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.
   4. Moisture content as necessary to achieve density.

H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, INLETS, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.

B. Below paved areas, encapsulate structure with cement stabilized sand; minimum of 12 inches below base, minimum 12 inches around walls, up to within 12 inches of pavement subgrade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use select

backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement.

C. In unpaved areas, encapsulate structure with cement stabilized sand; minimum of 1 foot below base, minimum 1 foot around walls, up to within 12 inches of finish grade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use suitable on-site material and topsoil for the 12-inch backfill directly under natural ground.

3.11 FIELD QUALITY CONTROL.

A. Test for material source qualifications as defined in Division 1.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Owner’s Representative.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.
1. For open cut construction projects and auger pits: Unless otherwise approved by Owner’s Representative, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.
2. A minimum of three density tests for each full shift of Work.
3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.
4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.
5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
7. Recompacted placement will be retested at same frequency as first test series, including verification tests.
8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Division 1.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Soil treatment for termite control.

1.2 DEFINITIONS

A. EPA: Environmental Protection Agency.

B. IPM: Integrated Pest Management. It is the policy of the Owner to use Integrated Pest Management (IPM) as the strategy for control of termites in and around Owner's facilities.

C. IPM Coordinator: Final authority for use and application of all pesticides

D. PCO: Pest control operator.

E. TDA SPCS: Texas Department of Agriculture – Structural Pest Control Service

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
1. Treatments and application instructions, including EPA-Registered Label.
2. Material Safety Data Sheets (MSDS).
3. Classification of Termiticide: Indicate as green listed, yellow listed, or red listed product as recognized by the TDA SPCS.
4. Concurrent with submission of product data to Architect, provide one copy of the submittal to Alvin ISD.
5. Proposed termiticides must be approved by the Owner / IPM coordinator prior to the start of any preparation or application.

C. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.

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.

E. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner IPM Coordinator's record information, including the following as applicable:
1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

C. Conform with all applicable codes and ordinances including the Federal Insecticide, Fungicide, and Rodenticide Act (7 United Sates Code 136 et seq.); Owner policies and procedures; Environmental Protection Agency regulations in 40 Code of Federal Regulations; Occupational Safety and Health Administration regulations; and state and local regulations.

D. Conform with approved termiticide list criteria established by the TDA SPCS

1.5 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.7 WARRANTY

A. General Warranty: Special warranty 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. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

C. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Criteria established in the most recent TDA SPCS definitions of these products.
1. Green List. All products must be from the following: inorganic termiticides (i.e., boric acid, disodium octoborate tetrahydrate, silica gels, diatomaceous earth); insect growth regulators; insect baits in tamper-resistant containers or for crack and crevice placement only; microbe-based insecticides; botanical insecticides (not including synthetic pyrethroids) containing not more than 5% synergists; biological (living) control agents.
2. Yellow List. All EPA Category III and IV termiticides (i.e., products carrying a CAUTION signal word) not included in the Green List, with the exception of restricted-use or state limited-use termiticides as defined under the Federal Insecticide, Fungicide, and Rodenticide Act and/or the Texas Agricultural Code.
3. Red List. All Category I and II termiticides (i.e., products carrying a WARNING or DANGER signal word), not included in the Green List, or restricted-use termiticides, or state limited-use termiticides as defined under the Federal Insecticide, Fungicide, and Rodenticide Act and/or the Texas Agricultural Code.

2.2 SOIL TREATMENT

A. Manufacturers:
1. BASF Corporation, https://pestcontrol.basf.us

2. Substitutions: None.

B. Termiticide: Use only BASF *Termidor* (no substitutions). Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. Applications shall be completed no less than seven days prior to initial occupancy of the structure, or as otherwise indicated on the termiticide label, whichever is longer.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency with compatible visible dye for visible inspection. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
   1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, piers, and chimney bases; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
   3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases.

Apply overall treatment only where attached concrete platform and porches are on fill or ground.

4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions and manufacturer's recommendations and requirements.

D. Post warning signs in areas of application as required for Commercial Treatment.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 31 63 29 - DRILLED CONCRETE PIERS AND SHAFTS

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. Dry-installed drilled piers.

1.3 UNIT PRICES

A. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts and bells.

1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.
3. There will be no additional compensation for excavation, concrete fill, reinforcing, casings, or other costs due to unauthorized over excavating of shafts or bells. No payment will be made for rejected piers.

1.4 ACTION SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections. In addition to Division 1 requirements, provide one half-size hard copy (paper) of any drawings submitted in the electronic files.

B. Product Data: For each type of product.

C. Design Mixtures: in accordance with Division 3 Section, “Cast-in-Place Concrete.”

D. Shop Drawings: in accordance with Division 3 Section, “Cast-in-Place Concrete.”

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Welding certificates.

C. Material Certificates and Test Reports in accordance with Division 3 Section, “Cast-in-Place Concrete.”

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record drawings.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Not less than three successfully completed contracts with similar soil conditions, shaft sizes, depths, and volumes of Work contained in this Project.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

D. Materials and installed work may require testing and retesting at any time during progress of Work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, are Contractor's responsibility.

E. Certificates of material properties, indicating, compliance with specified requirements, may be submitted in lieu of testing when acceptable to Architect/Engineer. Certificates of compliance must be signed by materials producer and Contractor.

1.8 FIELD CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.

1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Architect/Engineer/Owner no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Architect/Engineer's and Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

1. Additional test borings and other exploratory operations necessary for drilled piers may be made by Contractor at no additional cost to Owner.
2. The geotechnical report is referenced elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drilled-Pier Standard: Comply with ACI 336.1 except as modified in this Section.

B. Where provisions of above standard conflict with building regulations in effect for this Project, building regulations will govern, but only to establish minimum requirements.

2.2 STEEL REINFORCEMENT

A. Reinforcing bars and related materials are specified in Division 3 Sections.

2.3 CONCRETE MATERIALS

A. Concrete and related materials are specified in Division 3 Sections.

2.4 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283/A 283M, Grade C, or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:

1. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.
2. Special excavation includes excavation that requires special equipment or procedures where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.

    a. Special excavation requires use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.
    b. Earth seams, rock fragments, and voids included in rock excavation area are considered rock for full volume of shaft from initial contact with rock.

3. Demolition and removal of rock boulders, concrete, masonry, and other subsurface obstructions which are clearly indicated by Contract Documents, or by available subsurface exploration data, are not considered a change in the Work.

B. Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Pier design dimensions shown are minimums. The design of piers is based on assumed strata bearing capacity. If bearing stratum is not capable of maintaining bearing capacity assumed, foundation system will be revised as directed by Architect/Engineer. Revisions will be paid for in accordance with Contract conditions relative to changes in Work.

D. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.

1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
2. Remove water from excavated shafts before concreting.
3. Excavate rock sockets of dimensions indicated.

E. Dewatering: Provide and maintain pumping equipment to keep excavations free of water before placing concrete. If excessive water is encountered and drilling operations must be halted, consult with Architect/Engineer before using alternate methods of construction.

F. Conduct water to general site run off ditches and disposal areas with discharge lines. Provide ditching as required to conduct water to site drainage facilities.

G. Notify and allow Architect/Engineer and testing and inspecting agency to test and inspect bottom of excavation at least 24 hours prior to time excavations will be ready. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect/Engineer.

1. Do not excavate shafts deeper than elevations indicated unless approved by Architect/Engineer.
2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.

H. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

I. Temporary Casings: If required, install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.

1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
2. Casing length for payment for temporary casing shall be measured as the depth from the bottom of the casing to the ground surface.
3. When assumed elevation of top of bell portion is reached, casing may be stopped.

J. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.

1. Shore bells in unstable soil conditions to prevent cave-in during excavation, inspection, and concreting.

K. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit corrective construction proposals to Architect/Engineer for review before proceeding.

L. Depth of Bearing Stratum: If indicated depth of shaft excavation is reached without encountering required stratum bearing capacity, immediately suspend excavation operations and inform Architect/Engineer. Architect/Engineer will determine procedures to be followed.

M. Where changes in indicated depth or dimensions are required, or additional soil borings are required, proceed with such work when directed in writing by Architect/Engineer.

N. Overexcavation: No payment will be made for extra length, when pier shafts are excavated to a greater depth than required or authorized by Architect/Engineer, due to overdrilling by Contractor. Complete pier and fill extra depth with concrete if other conditions are satisfactory. Overexcavated shafts will be measured and paid for to original design or authorized depth.

3.3 STEEL REINFORCEMENT INSTALLATION

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
1. No splices are allowed in the vertical reinforcement without the prior written permission of the Architect/Engineer.

D. Accurately position, support, and secure reinforcement against displacement during concreting and the extraction of the casing from the shaft when temporary casings are utilized. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Place dowels in the pier as shown on the drawings.

G. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified testing laboratory.
   1. Do not place cold joints in drilled piers. Should unforeseen field conditions interrupt placing operations of over one hour duration, a cold joint installation will be required. Level top surface of concrete and insert joint dowel bars. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.

   1. Where concrete cannot be directed down shaft without striking reinforcement and/or where a drop of more than 12 feet is required, place concrete with chutes, tremies, or pumps.
   2. Vibrate top 12 feet of concrete of each shaft, minimum.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.

   1. Vibrate top 12 feet of concrete after withdrawal of temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Protect concrete work from frost, freezing, or low temperatures that could cause physical damage or reduced strength according to Division 3, Section “Cast in Place Concrete”.

   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to Division 3, Section “Cast in Place Concrete”.

   1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Drilled piers.
2. Excavation.
3. Concrete.
4. Steel reinforcement welding.
5. Special inspections required by the International Building Code 2009, Section 1705.8.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.

1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities are determined by testing and inspecting agency. Final evaluations and approval of data are determined by Architect/Engineer.

D. Concrete Tests and Inspections: Sample and test concrete for quality control during placement per Division 3 section, "Cast-In-Place Concrete."
1. Additional Tests: Testing and inspecting agency to make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect/Engineer.

a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.

2. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
3. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:

1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top, bottom, and bell.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Depth of rock socket.
11. Levelness of bottom and adequacy of cleanout.
12. Ground-water conditions and water-infiltration rate, depth, and pumping.
13. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.

14. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
15. Bell dimensions and variations from original design.
16. Date and time of starting and completing excavation.
17. Inspection report.
18. Condition of reinforcing steel and splices.
19. Position of reinforcing steel.
20. Concrete placing method, including elevation of consolidation and delays.
21. Elevation of concrete during removal of casings.
22. Locations of construction joints.
23. Concrete volume.
24. Concrete testing results.
25. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 32 01 90 – OPERATION & MAINTENANCE OF PLANTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes furnishing all labor, materials and equipment necessary to provide a landscape maintenance program including:

1. Running, monitoring, adjustments (both seasonal and plant needs based) and repair to the irrigation system.
2. Watering trees, shrubs and grass areas.
3. Replacement of plants that die.
4. Mowing and edging of school landscaping but not athletic fields.
5. Monitoring, weeding, and cultivating of plant material.
6. Application of organic fertilizers, insecticides, and herbicides.
7. General site clean up; removal of trash and products of maintenance.
8. Tree stake and supports removal at the end of the 12 month Maintenance period.

B. Application of herbicides and pesticides on school facilities is heavily regulated by Texas Department of Agriculture Commercial Applicator. The landscape maintenance contractor shall meet with the school district's IPM (Integrated Pest Management) coordinator prior to the first day of school to discuss responsibilities and methods for complying with TDA documentation and regulation requirements.

C. Excluded: The football and practice fields are not a part of this scope.

1.02 EXTRA SERVICES

A. All services not covered under this contract shall be considered "extra services" and will be charged for separately according to the nature of the item of work. The consent and authorization of the Owner or their authorized representative must be obtained prior to the performance or installation of such "extra services" items and prior to purchase of any chargeable materials.

B. Such work may include by-products of vandalism or other site related work.

1.03 MAINTENANCE REQUIREMENTS

A. Maintenance period shall begin upon satisfactory completion of punch list items generated from the Substantial Completion Review for the installation of the project and after the 60 day grow-in maintenance period. The Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 12 months.

B. Watering: Contractor is responsible for all watering (irrigation system operations and maintenance, adjustments, hand watering or temporary irrigation system). Watering shall consist of determining the plant watering requirements, adjustment of schedule and duration for coverage and elevation, and all other work required to maintain living plant material.

C. Trees, Shrubs, Groundcovers and Grass: Maintenance of new planting shall consist of watering, mowing, edging, cultivating, weeding, removal of undesirable volunteer plants, reseeding, mulching, re-staking, re-placing plants, tightening and repairing of guys, resetting plants to proper grades or upright position, restoration of the planting saucer and furnishing and applying such organic fertilizers, sprays and invigorates as are necessary to keep the plantings free of insects and disease and in thriving condition.

1.04 PROTECTION:

A. Protect planting areas against damage of all kinds for duration of maintenance period. Maintenance may include temporary protection fences, barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by Owner at no additional cost to Owner.

1.05 NEGLECT AND VANDALISM:

A. All plant material that is damaged or killed due to contractors operations, negligence or chemicals shall be replaced at no expense to the Owner. If plant damage or death is caused by conditions beyond the contractor's control, replacement shall be at the Owner's expense, but will need written authorization prior to replacement.

B. All water damage, either natural or man-made, resulting from contractor's neglect shall be corrected at the contractor's expense.

C. All damage to or thefts of landscaping not caused or allowed by the contractor shall be corrected by the contractor at the Owner's expense upon receipt of written authorization to proceed.

1.06 EMERGENCIES

A. Answer emergency or complaint calls regarding conditions in landscaped areas regarding fallen trees, broken water lines or other urgent site conditions and correct the problem or place warning signs and advise the Owner of the need for major work to be performed within 24 hours of the initial contact.

1.07 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Owner’s representative upon satisfactory

completion of all work, including maintenance, but exclusive of any required replacement of plant materials. Upon the final acceptance, the Owner will assume responsibility for maintenance of the work.

B. Plant material shall all be in healthy vigorous condition with no signs of stress or declining health.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials required for installed items shall match those already in use including MicroLife organic fertilizer.

2.02 REQUIRED EQUIPMENT

A. Contractor shall furnish the following equipment:

1. Riding lawn mowers
2. Push lawn mowers
3. Gasoline powered edgers
4. Line trimmers
5. Miscellaneous hand tools, trimmers, pruners, rakes, brooms, etc.
6. Blowers
7. Others as needed

PART 3 - EXECUTION

3.01 WATERING

A. It shall be the responsibility of the Contractor to assure that the correct watering of plant materials is being accomplished through the following irrigation services:

1. Regular watering to all new trees.
2. Regular watering to the shrubs, perennials, ornamental grasses and sodded lawns.
3. All adjustments for water delivery and all repair of the irrigation system for any and all damage to the system during the course of the maintenance period.
4. Seasonally adjusting the irrigation controller.

B. The irrigation system will be thoroughly inspected once per month. Check clock setting, clock operation, head elevation and coverage, valve function, vacuum breaker, and verify that all heads are intact and secure. Contractor to repair any issues that he finds.

3.02 MAINTENANCE OF SODDED LAWN AND HYDROMULCH

A. Reseed areas as needed to get hydromulch areas growing and water.

B. The Contractor will be responsible for replacing soils that have eroded. Residual soils will be removed and if not mingled with objectionable materials, may be re-used in eroded areas.

C. Immediately upon observing any undesirable volunteer plants or seedlings, contractor shall promptly remove. The Contractor shall initiate a program of mechanical removal and maintain this program throughout the maintenance period.

D. Special effort shall be given to the control of fire ants infesting the site. After control is accomplished, the ant mounds shall be lowered and tamped to the existing grade.

E. Removal of debris from the site unrelated to horticultural maintenance (paper, bottles, cans, "Pirate" signs, etc.) and construction debris shall be the responsibility of the maintenance Contractor. Frequency shall be as per Landscape Maintenance Program.

F. Sod lawn areas shall be mowed and edged as a part of this section. Frequency shall be as per Landscape Maintenance Program. No mowing within 75’-100’ of children outside on site and no mowing during SCHOOL ZONE hours at drop off and pick up.

3.03 MAINTENANCE OF TREES, SHRUBS and GROUNDCOVERS

A. Contractor shall adjust and tighten as required all tree staking and guying. Removal as directed by Owner's Representative at the end of the 12 month maintenance period.

B. Contractor shall deep water all new trees until there are definite signs the trees have established themselves and are pushing out new growth.

C. Contractor shall trim broken branches and trunk suckers from trees and shrubs. All pruning equipment shall be sharp and clean.

PART 4 - MAINTENANCE FREQUENCY SCHEDULE

4.01 MAINTENANCE OPERATIONS - See Exhibits A, B, C

Month Minimum Number of Visits per Month January
2
February 2
March 4
April 4
May 4
June 4
July 4
August 4
September 4
October 3

November 3
December 2

4.02 TOPDRESS FERTILIZER

A. Sixty (60) days prior to expiration of 12 month maintenance obligation.

4.03 MULCHING, WEED CONTROL AND GUYING ADJUSTMENT

A. As required at each visit.

B. Add fresh mulch 30 days (30) prior to the expiration of 12 month maintenance obligation.

4.04 TRASH AND DEBRIS REMOVAL

A. Collect all trash and debris at each visit and dispose of off site.

END OF SECTION 32 01 90

SECTION 32 11 13.13 – LIME-TREATED SUBGRADES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Foundation course of lime stabilized natural subgrade material.

1.2 UNIT PRICES

A. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

A. ASTM D698 - Tests for Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 5.5 lb Rammer and 12 inch Drop.

B. ASTM D1140 - Method of Test for Amount of Material in Soils Finer than the No. 200 Sieve.

C. ASTM D1556 - Density of Soil in Place by the Sand-Cone Method.

D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D3017 - Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-600-J - Lime Testing Procedure.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Division 1.

B. Submit certificates stating that hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

D. Submit manufacturer's description and characteristics for rotary speed mixer and compaction equipment for approval.

1.5 TESTS

A. Testing will be performed under provisions of Section - Testing Laboratory Services.

B. Tests and analysis of soil materials will be performed in accordance with ASTM D4318.

C. Sampling and testing of lime slurry shall be in accordance with Tex-600-J.

D. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.

E. Soil will be evaluated to establish percent of hydrated lime, quicklime, or lime slurry to be applied to subgrade material.

F. Moisture-density relationship will be established on material sample from roadway, after stabilization with lime, in accordance with ASTM D698.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

C. Quicklime can be dangerous; exercise extreme caution if used for the Work. Contractor shall become informed about recommended precautions in the handling, storage and use of quicklime.

PART 2 P R O D U C T S

2.1 WATER

A. Water shall be clean; clear; and free from oil, acids, alkali, or vegetable matter.

2.2 LIME

A. Type A - Hydrated lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide and magnesium hydroxide.

B. Type B - Commercial lime slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.

C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:
   1. Grade DS: Pebble quicklime of a gradation suitable for use in the preparation of a slurry for wet placing.
   2. Grade S: Finely-graded quicklime for use in the preparation of a slurry for wet placing. Do not use grade S quicklime for dry placing.

D. Lime shall conform to requirements of Item 260 of the 1993 Texas Department of Transportation Standard Specifications.

E. Lime slurry may be delivered to the job site as commercial lime, or may be prepared at the job site by using hydrated lime or quicklime. The slurry shall be free of liquids other than water and shall be of a consistency that can be handled and uniformly applied without difficulty.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify subgrade lines and grades are correct.

3.2 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:
   1. Cutters accurately provide a smooth surface over entire width of cut to plane of secondary grade.
   2. Visible indication that cut is to proper depth.

C. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting. Obtain uniform stability.

3.3 LIME SLURRY APPLICATION

A. Mix hydrated lime or quicklime with water to form a slurry of the solids content specified. Commercial lime slurry shall have dry solids content as specified. Conform to cautionary requirements of Paragraph 1.6C concerning use of quicklime.

B. Apply slurry with a distributer truck equipped with an agitator to keep lime and water in a consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on the same working day.

C. Apply so that dry subgrade will contain a minimum lime content by weight of dry subgrade as instructed by Testing Laboratory and detailed in Geotechnical Report.

3.4 PRELIMINARY MIXING

A. Do not mix and place material when temperature is below 40 degrees F and falling. Base may be placed when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain a homogeneous friable mixture free of clods and lumps.

C. Shape mixed subgrade to final lines and grades.

D. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.5C can be met during preliminary mixing:
   1. Seal subgrade as a precaution against heavy rainfall by rolling lightly with light pneumatic rollers.
   2. Cure soil-lime material for 1 to 4 days. Keep subgrade moist during cure.

E. Stabilized subgrade shall extend a minimum of two feet beyond edge of pavement or back or curb as applicable.

3.5 FINAL MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.

B. Add water to bring moisture content of soil mixture to a minimum of optimum or above.

C. Mix and pulverize until all material passes a 1-3/4-inch sieve; a minimum of 85 percent, excluding nonslacking fractions, passes a 3/4-inch sieve; and a minimum of 60 percent excluding nonslacking fractions passes a No. 4 sieve.

D. Shape mixed subgrade to final lines and grades.

E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.6 COMPACTION

A. Aerate or sprinkle to attain optimum moisture content as determined by Testing Laboratory. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

B. Start compaction immediately after final mixing, unless approved by Engineer.

C. Spread and compact in two or more approximately equal layers where total compacted thickness is to be greater than 8 inches.

D. Compact with approved heavy pneumatic or vibrating rollers, or a combination of tamping rollers and light pneumatic rollers. Begin compaction at the bottom and continue until entire depth is uniformly compacted.

E. Do not allow stabilized base to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.

F. Compact to following minimum densities at a moisture content of optimum to 3 percent above optimum as determined by ASTM D698, unless otherwise indicated on the Drawings:
1. Areas to receive pavement without subsequent base course: Minimum density of 95 percent of maximum dry density.
2. Areas to receive subsequent base course: Minimum density of 95 percent of maximum dry density.

G. Seal with approved light pneumatic tired rollers: Prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

3.7 CURING

A. Moist cure for a minimum of 3 days before placing base or surface course, or opening to traffic. Time may be adjusted as approved by Engineer. Subgrade may be opened to traffic after 2 days if adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base, surface, or seal course within 14 days after final mixing and compaction unless prior approval is obtained from the Engineer.

3.8 TOLERANCES

A. Completed surface shall be smooth and conform to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.9 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section - Testing Laboratory Services.

B. A minimum of one phenolphthalein test will be made at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Contractor may, at his own expense, request additional cores in the vicinity of cores indicating nonconforming in-place depths. If the average of the tests falls below the required depth, place and compact additional material at no cost to the Owner.

D. Compaction Testing will be performed in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017 at a random locations near depth determination tests. Rework and recompact areas that do not conform to compaction requirements at no cost to the Owner.

E. Fill test sections with new compacted lime stabilized subgrade.

3.10 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect the asphalt membrane, if used, from being picked up by traffic.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION

SECTION 32 11 29.13 – LIME-FLY ASH-TREATED BASE COURSES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Foundation course of lime/fly ash stabilized subgrade material.
   1. Application of lime slurry and fly ash to subgrade.
   2. Mixing, compaction, and curing of lime, slurry, fly ash, water and subgrade into a stabilized foundation.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 DEFINITIONS

A. Moist Cure: Curing soil lime/fly ash material to obtain optimum hydration.

B. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.4 REFERENCES

A. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit certification that fly ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of materials to work site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Conform to requirements of Division 2.

B. Quicklime can be dangerous; exercise extreme caution if used for Work. Become informed about recommended precautions in handling, storage and use of quicklime.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Water: clean, clear and free from oil, acids, alkali, or vegetable matter.

B. Conform to requirements of City of Houston Standard Specifications Section 02336 – Lime Stabilized Subgrade for Type A hydrated lime, Type C quicklime, and Type B commercial lime slurry.

C. Fly ash: Residue or ash remaining after burning finely pulverized coal at high temperatures conforming to requirements of ASTM C 618, Type ‘C” or “F” and following:
   1. Minimum CaO content of 20 percent
   2. Loss on ignition not to exceed 3 percent
   3. Contain no lignite ash

D. Asphaltic Seal Cure: Conform to requirements of Division 32.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to City of Houston Standard Specifications Section 02336 – Lime Stabilized Subgrade with following exceptions:
   1. Include fly ash in percentage amounts in lime or lime slurry as established from geotechnical evaluation for application, mixing, and compaction.
   2. Apply lime/fly ash as single mix, single pass over lower PI soils.
   3. Conduct operations to minimize elapsed time between mixing and compacting lime/fly ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing last stabilizing agent.

B. Stabilized subgrade shall extend two feet beyond edge of pavement or back of curb as applicable.

3.2 QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. Soil will be sampled to establish percent of fly ash and hydrated lime, quicklime, or lime slurry to be applied to subgrade material.

C. Testing will be in accordance with Division 1.

END OF SECTION

SECTION 32 13 13.00 - CONCRETE PAVING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 185 - Standard Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

D. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

E. ASTM C 33 - Standard Specifications for Concrete Aggregates.

F. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

G. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

H. ASTM C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

I. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).

J. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

K. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

L. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

M. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

N. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

O. ASTM C 150 - Standard Specification for Portland Cement.

P. ASTM C 174 - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.

Q. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

R. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

S. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

U. TxDOT Tex-203-F - Sand Equivalent Test.

V. TxDOT Tex-406-A - Material Finer than 75 Fm (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual compressive strength obtained from design mixes at required test ages.

C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.

D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 82. Provide specimens for testing when required by Owner’s Representative.

1.5 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without written permission of Owner’s Representative.

B. Class of aggregate being used may be changed before or during Work with written permission of Owner’s Representative. Comply new class with specifications.

C. Reject segregated aggregate. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

D. Reject aggregates mixed with dirt, weeds, or foreign matter.

E. Do not dump or store aggregate in roadbed.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Portland Cement:
1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.
2. Bulk cement which meets referenced standards may be used when method of handling is approved by Owner’s Representative. When using bulk cement, provide satisfactory weighing devices.
3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by Owner’s Representative.

B. Water: Conform to requirements for water in ASTM C 94.

C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).

1. Maximum percentage by weight of deleterious substances shall not exceed following values:

Item	Percentage by Weight of Total Sample Maximum
Clay lumps and friable particles	3.0
Material finer than 75-µm (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All other concrete	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

* In case of manufactured sand, when material finer than 75-µm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 1/2 inch to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1¾" sieve	0
Retained on 1½" sieve	0 to 5
Retained on ¾" sieve	30 to 65
Retained on 3/8" sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test	
*Method Tex-406-A	1.0 maximum

* In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.

E. Mineral Filler: Type “C” or Type “F” fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture as approved by the Engineer. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementatious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.

F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Owner’s Representative.

H. Reinforcing Steel:
1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.
2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.
3. Provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.

2.2 EQUIPMENT

A. Conform Equipment to requirements of ASTM C 94.

2.3 MIXING

A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.

B. Mix design to produce concrete which will have minimum compressive strength of 3,000 psi at 7 days and 3,500 psi at 28 days. Slump of concrete shall be at least 2 inches but no more than 5 inches, when tested in accordance with ASTM C 143.
1. Concrete pavement, including curb, curb and gutter, and saw-tooth curb, shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water-cement ratio maximum 0.57). Determine cement content in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.
2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.
3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.

4. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

C. Use high early strength concrete pavement to limits shown on Drawings. Design to meet following:
1. Concrete Mix: Compressive strength greater than or equal to 3,500 psi at 72 hours.
2. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.
3. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5 inches, when tested in accordance with ASTM C 143.
4. Other requirements for proportioning, mixing, execution, testing, etc., shall be in accordance with this Division 32.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify compacted base is ready to support imposed loads and meets compaction requirements.

B. Verify lines and grades are correct.

3.2 PREPARATION

A. Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.

B. Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.3 EQUIPMENT

A. Alternate equipment and methods, other than those required by this Section, may be used provided equal or better results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order.

B. Subgrade Planer and Template:
1. Use subgrade planer with adjustable cutting blades to trim subgrade to exact section shown on Drawings. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form, and have strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8 inch. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.
2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8 inch. Fit template with accurately adjustable rods projecting downward at 1 foot intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.

C. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately

adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.

D. Hand Finishing:
1. Provide mechanical strike and tamping template 2 feet longer than width of pavement to be finished. Shape template to pavement section.
2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.

E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10 ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3 foot width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.

F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.

G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.
1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.
2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.
3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

3.4 FORMS

A. Side Forms: Use forms of approved shape and section. Form depth shall be equal to required edge thickness of pavement. Forms with depths greater or than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1 inch. Length of form sections shall be not less than 10 feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200 foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10 feet in length or curved forms may be used.

B. Form Setting:
1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 feet of length. Do not remove forms for at least 8 hours after

completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300 feet ahead of mixer or as approved by Owner's Representative.

2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

3.5 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.

B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.

C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.

D. Secure in required position to prevent displacement during placing and finishing of concrete.

E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.

F. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

3.6 FIBROUS REINFORCING

A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

3.7 PLACEMENT

A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.

B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.

C. Concrete slump during placement shall be 2 to 5 inches, except when using traveling-form paver, slump shall be maximum of 2 inches.

D. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10 feet long.

E. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.8 COMPACTION

A. Consolidate concrete using mechanical vibrators as specified herein. Extend vibratory unit across pavement, not quite touching side forms. Space individual vibrators at close enough intervals to vibrate and consolidate entire width of pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.9 FINISHING

A. Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods.
   1. Hand finish with mechanical strike and tamping template in same width as pavement to be finished. Shape template to pavement section shown on Drawings. Move strike template forward in direction of placement, maintaining slight excess of material in front of cutting edge. Make minimum of two trips over each area. Screed pavement surface to required section. Work screed with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.

B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.

C. After completion of straightedge operation, make first pass of burlap drag or transverse broom as soon as construction operations permit and before water sheen has disappeared from surface. Follow with as many passes as required to produce desired texture depth. Permit no unnecessary delays between passes. Keep drag wet, clean and free from encrusted mortar during use.

D. Concrete finish shall be complete in a uniform, workman like manner. Excessive roughness from burlap or broom finishing may be cause for removal and replacement from Owner.

E. Contractor shall immediately clean any concrete spillage from existing pavements. If concrete spillage is allowed to dry on existing pavements, it shall be the Contractor’s responsibility to remove the excess concrete and repair the existing concrete to like-new condition. Owner may reject repairs and require removal and replacement of the area.

3.10 JOINTS AND JOINT SEALING

A. Conform to requirements of Division 32.

3.11 CONCRETE CURING

A. Conform to requirements of Division 32.

3.12 TOLERANCES

A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10 foot straightedge parallel to center of roadway to bridge depressions and touch high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16 inch per foot from nearest point of contact. Maximum ordinate with 10 foot straightedge shall not exceed

1/8 inch. Grind spots in excess of required tolerances to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.13 FIELD QUALITY CONTROL

A. Perform testing under provisions of Division 1.

B. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Owner's Representative for high early strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Minimum compressive strength shall be 3000 pounds per square inch for first two specimens at 7 days and 3500 pounds per square inch at 28 days.

C. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. Minimum of one 4 inch core will be taken at random locations per 375 feet per 12 feet lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3,500 pounds per square inch.

E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in-place depths at no cost to Owner. In-place depth at these locations shall be average depth of four cores.

F. Fill cores and density test sections with new concrete paving or non-shrink grout.

3.14 NONCONFORMING PAVEMENT

A. Remove and replace areas of pavement found deficient in thickness, or that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. When measurement of any core is less than specified thickness, actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to Owner.

3.15 UNIT PRICE ADJUSTMENT

A. The Owner may chose to adjustment payment for nonconforming concrete.

3.16 PAVEMENT MARKINGS

A. Restore pavement markings to match those existing in accordance with the applicable governmental standard specifications and details and Owner's Representative's requirements.

3.17 PROTECTION

A. Barricade pavement section to prevent use until concrete has attained minimum design strength. Cure barricade pavement section for minimum 72 hours before use. Do not open pavement to traffic until concrete is at least 10 days old. Pavement may be open to traffic earlier provided Contractor pays for testing and additional specimen once 7 day specified strength is obtained. Pavement may be opened when high early strength concrete is used meeting specified 72 hour strength.

B. High early strength concrete may be used to provide access at driveways, street intersections, esplanades and other locations approved by Owner's Representative.

C. On those sections of pavement to be opened to traffic, seal joints, clean pavement, and place earth against pavement edges before permitting use by traffic. Opening of pavement to traffic shall not relieve responsibility for Work.

D. Maintain concrete paving in good condition until completion of Work.

E. Repair defects by replacing concrete to full depth.

END OF SECTION

SECTION 32 13 13.10 - CONCRETE PAVEMENT CURING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 156 - Standard Test Method for Water Retention by Concrete Curing Materials.

B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 P R O D U C T S

2.1 COVER MATERIALS FOR CURING

A. Conform curing materials to one of the following:
1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.
2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.
3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitch mats so that mat will contact surface of pavement at all points when saturated with water.

2.2 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m2 in 72 hours using test method ASTM C 156.

PART 3 E X E C U T I O N

3.1 CURING REQUIREMENT

A. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.

B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.2 POLYETHYLENE FILM CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.

B. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or replacing.

3.3 WATERPROOFED PAPER CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Overlap joints in blankets caused by joining paper sheets not less than 5 inches and securely seal with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure overlap of at least 12 inches. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects.

3.4 COTTON MAT CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.

B. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.5 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

B. Moisten concrete by water fogging prior to application of membrane when surface has become dry.

C. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Owner’s Representative, but not less than one gallon per 200 square feet of surface area.

3.6 TESTING MEMBRANE

A. Treated areas will be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.

B. Re-Apply membrane compound immediately at no cost to Owner when membrane fails above test.

END OF SECTION

SECTION 32 13 13.25 - CONCRETE SIDEWALKS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in Field.

B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

E. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

F. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

G. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statues.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit certified testing results and certificates of compliance.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Division 32.

B. Reinforcing Steel: Conform to material requirements of Division 32. Use No. 3 reinforcing bars.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Division 31.

E. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. The use of 2 inch by 4 inch lumber as forms will not be allowed.

F. Sand Bed: Conform to material requirements for bank run sand of Division 31.

G. Sodding: Conform to material requirements for sodding of Division 31.

H. Coloring for wheelchair ramps: use integrally colored concrete (no surfacing painting allowed). Verify color with Owner/Architect (typically Red Brick).

PART 3 E X E C U T I O N

3.1 REPLACEMENT

A. Replace sidewalks and slope paving which are removed or damaged during construction with thickness and width equivalent to one removed or damaged, unless otherwise shown on Drawings. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.

B. Provide replaced and new sidewalks with wheelchair ramps when sidewalk intersects curb at street or driveway.

3.2 PREPARATION

A. Identify and protect utilities which are to remain.

B. Protect living trees, other plant growth, and features designated to remain.

C. Conduct clearing and grubbing operations in accordance with Division 31.

D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with Division 31. Compact subgrade to minimum of 90 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.

E. Immediately after subgrade is prepared, begin form work and concrete placement.

3.3 PLACEMENT

A. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4's as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.

B. Reinforcement:
1. Install reinforcing bars.
2. Install reinforcing steel as shown on the drawings. Lay longitudinal bars in walk continuously, except through expansion joints.
3. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.
4. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.

5. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

C. Expansion Joints: Install expansion joints with load transfer units in accordance with Division 32.

D. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.

E. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.

F. Wheelchair ramps located in the Public ROW shall have a contrasting color. Color shall be part of the concrete mix (i.e. no painting or coatings). Wheelchair ramps located on-site are not required to be a contrasting color.

G. Unless otherwise indicated on Drawings, mark off sidewalk joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.

H. Finish edges with tool having 1/4 inch radius.

I. After concrete has set sufficiently, refill space along sides of sidewalk to one-inch from top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Division 1. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Division 32.

3.4 CURING

A. Conform to requirements of Division 32.

3.5 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. Compressive Strength Test Specimens: Four test specimens for compressive strength test will be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in one day. Two specimens will be tested at 7 days. Remaining two specimens will be tested at 28 days. Specimens will be tested in accordance with ASTM C 39. Minimum compressive strength: 2500 psi at 7 days and 3000 psi at 28 days.

C. Yield test for cement content per cubic yard of concrete will be made in accordance with ASTM C 138. When cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. If the Contractor places concrete without notifying the laboratory, the Owner will have the concrete tested by means of core test as specified in ASTM C 42. When concrete does not meet specification, cost of test will be deducted from payment.

E. Sampling of fresh concrete shall be in accordance with ASTM C 172.

F. Take slump tests when cylinders are made and when concrete slump appears excessive.

G. Concrete shall be acceptable when average of two 28 day compression tests is equal to or greater than minimum 28 day strength specified.

H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.

I. If 28 day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Owner's Representative. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due.

3.6 NONCONFORMING CONCRETE

A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. Replace nonconforming sections at no additional cost to Owner.

3.7 PROTECTION

A. Maintain newly place concrete in good condition until completion of Work.

B. Replace damaged areas.

END OF SECTION

SECTION 32 13 17 – INTEGRALLY COLORED DECORATIVE CONCRETE SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete paving with integral coloring within the mix.

B. Related Sections:
1. Section 32 13 13.25 - Concrete Sidewalks: Construction of exterior concrete flatwork.
2. Section 32 13 73 – Concrete Paving Joints and Sealants.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures.

B. Product Data: Manufacturer’s printed literature for product description, mixing, and installation instructions for pigments.

C. Concrete Mix Design: Submit mix designs and aggregate analysis of each class of concrete. Designs shall be submitted a minimum of 48 hours prior to the placement of any concrete.

1. Mix designs shall include material proportions, material weights, material sources, manufacturer's data on any admixture used, and proof that the design meets the requirements of this specification.
2. Include the water/cement ratio, slump, and the compressive strengths from concrete test cylinders.
3. Aggregate analysis shall include the sieve analysis, dry rodded unit weight of coarse aggregate, and the specific gravities of both fine and coarse aggregates.

D. Mockups: For each color selected provide onsite sample minimum 48” square in the selected color(s).

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of the products specified.

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

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meetings.

B. Pre-installation Conference: Conduct conference at Project site.
1. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Decorative concrete paving Installer.

PART 2 - PRODUCTS

2.1 PIGMENT MANUFACTURERS

A. BASF Construction Chemicals, Master Builders.
B. Bomanite Corporation
C. ChemMasters
D. Lambert Corporation

E. L.M. Scofield Company

F. Substitutions: Section 01 60 00 - Product Requirements

2.2 MATERIALS

A. Concrete: Provide formwork, reinforcing, and cast-in-place concrete in accordance with Section 32 13 13.25.

1. Cement: Natural gray color cement.
2. Sand: Locally available color.
3. Aggregate: Concrete producer’s standard aggregate for non-exposed condition.
4. Slump: Not to exceed 5-inches.
5. In order to ensure uniformity of color, use no calcium chloride.

B. Basis of Design: *Chromix Admixture* in powdered or liquid form as manufactured by Scofield or approved equivalent.

1. Admixture shall be a colored, water-reducing admixture containing no calcium chloride withcoloring agents that are limeproof and UV resistant.
2. Colored admixture shall conform to the requirements of ACI 303.1, ASTM C979, ASTM C494, and ASSHTO M194.
3. Color(s) selected from Scofield standard color chart A-312.

C. Curing and Sealing Compound

1. Combination curing compound and sealer specifically formulated for use with integrallycolored exterior concrete flatwork.
2. Basis of Design: *Cureseal-S* in matte finish as manufactured by Scofield or approved equivalent provided by selected color admixture manufacturer.
3. Complies with ASTM C309.

2.3 CONCRETE MIXTURES

A. Prepare concrete in accordance with Section 32 13 13.2, whether mixed at the job site or at the concrete plant.

B. Color Pigment:
1. Ensure that Owner’s testing laboratory has checked concrete mix at the site and approved for placement prior to adding color pigment.
2. Add color pigment to approved concrete mixture and thoroughly mix within the drum in accordance with pigment manufacturer's written instructions and as required to result in hardened concrete color consistent with approved samples and mockups.

C. Do not add water to plant mixes in the field.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Examine and prepare subgrade surfaces in accordance with Section 32 13 13.25.

3.2 FORMWORK AND REINFORCING INSTALLATION

A. Install formwork and reinforcing in accordance with Section 32 13 13.25.

3.3 CONCRETE PLACEMENT

A. Place concrete in accordance with Section 32 13 13.25.

B. Screed paving surface with a straightedge and strike-off.

C. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.4 FINISHING

A. Draw soft bristle broom across freshly floated concrete to produce medium-to-fine line texture in straight lines perpendicular to main line of traffic. Do not dampen brooms. Do not sprinkle or add water to the finish.

B. Where practicable, place and finish all integrally colored concrete at one time to reduce variation in final color.

C. Finishing: After final power floating, apply medium-to-fine textured broom finish. Draw a soft bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture matching approved mockup.

3.5 CURING

A. Apply specified curing/sealing compound for integrally colored concrete in accordance with manufacturer’s printed instructions.

B. Apply curing/sealing compound at consistent time for each concrete pour to maintain close color consistency.

C. Curing/sealing compound shall be clear or same color as the color admixture and provided bythe same manufacturer of the color admixture.

D. Take precautions in hot weather to prevent cracking due to rapid surface drying. Do not cover colored concrete with plastic sheeting.

3.6 REPAIRS AND PROTECTION

A. Repair and protect paving in accordance with Section 32 13 13.10.

B. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Broom-clean paving immediately prior to Substantial Completion of Project.

END OF SECTION

SECTION 32 13 73 - CONCRETE PAVING JOINTS AND SEALANTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

C. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. ASTM D 3405 - Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

E. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit product data for joint sealing compound and proposed sealing equipment for approval.

C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 P R O D U C T S

2.1 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:
   1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
   2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.2 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.3 JOINT SEALING COMPOUND

A. Provide joint sealant as indicated on the drawings.

2.4 LOAD TRANSMISSION DEVICES

A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.

B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.5 SUPPORTS FOR REINFORCING STEEL AND JOINT ASSEMBLY

A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Owner's Representative.

PART 3 E X E C U T I O N

3.1 PLACEMENT

A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling, or cracks.

3.2 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.3 EXPANSION JOINTS

A. Place 3/4 inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 60 feet apart or as shown on the drawings. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.4 CONSTRUCTION JOINTS

A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

B. Required only if noted on plans.

3.5 LONGITUDINAL WEAKENED PLANE JOINTS

A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15 feet in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

B. Required only if noted on plans.

3.6 SAWED JOINTS

A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of 1/4 inch wide. Maintain depth of one quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 12 hours of concrete placement. Saw joints at required spacing (15' maximum between sawed joints) consecutively in sequence of concrete placement.

B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

C. Reference plans for requirements on sealing sawed joints.

3.7 JOINTS FOR CURB, CURB AND GUTTER

A. Place 3/4 inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120-foot centers.

B. Expansion joints in curbs shall be sealed to match expansion joints in pavement.

3.8 JOINTS FOR CONCRETE SIDEWALKS

A. Provide 3/4 inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 40 feet.

B. Sidewalk expansion joints shall be sealed to match expansion joints in pavement.

3.9 JOINTS FOR CONCRETE DRIVEWAYS

A. Provide 3/4-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

B. Driveway expansion joints shall be sealed to match expansion joints in pavement.

3.10 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.

B. Use joint sealing equipment in like new working condition throughout joint sealing operation, and be approved by Owner's Representative. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

A. Maintain joints in good condition until completion of Work.

B. Replace damaged joints material with new material as required by this Section.

END OF SECTION

SECTION 32 16 13 – CURBS AND GUTTERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit details of proposed form work for approval.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Division 32.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Division 32.

C. Grout: Nonmetallic, non-shrink grout containing no chloride producing agents conforming to the following requirements.
   1. Compressive strength
      a. at 7 days: 3500 psi
      b. at 28 days: 4000 psi
   2. Initial set time: 45 minutes
   3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Division 32.

F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Owner’s Representative.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.2 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Division 32. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4 inch deep using approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.3 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4 inch edger. Finish edges with tool having 1/4 inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.4 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Owner’s Representative. Use of mechanical methods shall provide specified curb design and finish.

3.5 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Division 32.

3.6 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.7 PROTECTION

A. Maintain curbs and gutters in good condition until completion of Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. This Section specifies the requirements for providing pavement markings of the following types.

1.2 UNIT PRICES

A. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 QUALITY ASSURANCE

A. All markings shall comply with the requirements of the SDHPT Standard Specifications for Construction of Highways, Streets and Bridges, the SDHPT Manual on Uniform Traffic Control Devices for Streets and Highways and the applicable regulations and standards of Harris County, Texas and the City.

B. Reference Standards Applicable to this Section:
   1. FS: Federal Specifications and Standards:
      a. TT-P-1952E: Paint, Traffic and Airfield Marking, Waterbourne
   2. SDHPT: Texas State Department of Highways and Public Transportation:
      a. Standard Specifications for Construction of Highways, Streets and Bridges.
      b. Texas Manual on Uniform Traffic Control Devices for Streets and Highways (TMUTCD).
      c. The above referenced SDHPT standards may be obtained from:

         State Department of Highways & Public Transportation Highway Building
         11th and Brazos Streets
         Austin, Texas 78701
         Tel: (512) 475-2081

1.4 SUBMITTALS

A. Certificates:
   1. Certificates shall be submitted for each product indicating that the product complies with the requirements of this specification.

B. Manufacturer's Data:
   1. Manufacturer's installation instructions, specifications and recommendations shall be submitted for each pavement marking product.

1.5 JOB CONDITIONS

A. Markings shall be installed only on clean and dry surfaces. Paint markings shall be applied only when surfaces have the following minimum temperatures:
   1. A minimum of 50 degrees F for asphalt and a minimum of 60 degrees F for concrete.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Paint:
   1. Marking paint shall be traffic white, yellow, or as designated on the drawings, and shall comply with the requirements of FS TT-P-1952E.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Markings shall be installed and surfaces prepared in accordance with the requirements of the applicable item in the SDHPT Standard Specifications and the TMUTCD.

B. Markings shall be protected from vehicular traffic until not subject to damage by such traffic. Contractor shall be responsible for repair and replacement of markings until written acceptance by the Owner.

END OF SECTION

SECTION 32 18 16 - PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Organic loose-fill surface.

1.2 DEFINITIONS

A. Critical Height: Standard measure of shock attenuation. According to CPSC No. 325, this means "the fall height below which a life-threatening head injury would not be expected to occur."

1.3 PERFORMANCE REQUIREMENTS

A. Impact Attenuation: According to ASTM F 1292.

B. Accessibility of Surface Systems: According to ASTM F 1951.

C. Minimum Characteristics for Organic Loose-Fill Surfaces: According to ASTM F 2075.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For each playground surface system, include materials, plans, cross sections, drainage, installation, penetration details, and edge termination including loose fill edgings.

D. Samples for Initial Selection: For each type of playground surface system indicated.
   1. Include similar Samples of playground surface system and accessories involving color selection.

E. Samples for Verification: For each type of playground surface system indicated.
   1. Minimum 1-quart loose-fill surface sealed in a container.
   2. Minimum 12-by-12-inch Sample of geosynthetic fabric.

F. Product Schedule: For playground surface systems.

G. Coordination Drawings: 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. Extent of surface systems and use zones for equipment.
   2. Critical heights for playground surfaces and fall heights for equipment.

H. Qualification Data: For qualified Installer.

I. Material Certificates: For each type of loose-fill playground surface system, from manufacturer.

J. Material Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each loose-fill playground surface system.

K. Field quality-control reports.

L. Maintenance Data: For playground surface system to include in maintenance manuals.

M. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain playground surface system materials from single source from single manufacturer.
   1. Provide secondary materials and repair materials of type and from source recommended by manufacturer of playground surface system materials.

C. Standards and Guidelines: Comply with CPSC No. 325, "Handbook for Public Playground Safety"; ASTM F 1292; and ASTM F 1487.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit playground surface system installation to be performed according to manufacturers' written instructions and warranty requirements.

1.7 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of playground surface system that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Reduction in impact attenuation.
      b. Deterioration of surface and other materials beyond normal weathering.
   2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ORGANIC LOOSE-FILL SURFACE

A. Engineered Wood Fibers: Random-sized wood fibers, in manufacturer's standard fiber size, approximately 10 times longer than wide; containing no bark, leaves, twigs, or foreign or toxic materials according to ASTM F 2075; graded according to manufacturer's standard specification for material consistency for playground surfaces.
   1. Products:
      a. Fibar Group LLC; Fibar System.
      b. GameTime; GT Impax Fiber.
      c. New England Bark Mulch & Playground Surfacing; Playground Safety Fiber.
      d. Sof'Solutions Inc.; Sof'Fall.
      e. Zeager Bros., Inc.; Wood Carpet.
      f. Substitutions: Section 01 60 00 - Product Requirements.
   2. Critical Height: In accordance with CPSC No. 325, 6 feet minimum.
   3. Uncompressed Material Depth: Not less than as required for critical height indicated.

2.2 LOOSE-FILL ACCESSORIES

A. Edgings: Anchored-in-place, weather-resistant containment barrier designed to minimize sharp edges, protrusions, and tripping hazards; formed by interconnected, modular units.
   1. Polyethylene Units: UV-light-stabilized polyethylene, not less than 1/4-inch wall thickness; made into smooth-surfaced straight and curved units with radiused exposed edges and integral, molded-in color; in manufacturer's standard sizes.
      a. Color: As selected by Architect from manufacturer's full range.
   2. Anchor Stakes: Manufacturer's standard, of corrosion-resistant-coated metal or noncorrodible material, designed to be non-protruding when installed, for connecting

units and securing in-place.

3. Wear Mats: Manufacturer’s EPDM and SBR rubber mats designed for installation at high wear areas.

2.3 GEOSYNTHETICS

A. Drainage/Separation Geotextile: Nonwoven, needle-punched geotextile, manufactured for subsurface drainage applications and made from polyolefins or polyesters. Complying with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
   1. Weight: 4 oz./sq. yd. according to ASTM D 5261.
   2. Water Flow Rate: 100 gpm/sq. ft. according to ASTM D 4491.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, subgrade and substrate conditions, drainage, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. General: Prepare substrates to receive surfacing products according to playground surface system manufacturer's written instructions. Verify that substrates are sound and without high spots, ridges, holes, and depressions.

B. Grade surface of substrate to 1 to 2 percent slope for drainage. Do not exceed 10 percent slope.

3.3 INSTALLATION, GENERAL

A. General: Comply with playground surface system manufacturer's written installation instructions. Install playground surface system over area and in thickness indicated.

3.4 GEOSYNTHETIC INSTALLATION

A. General: Install geosynthetics according to playground surface system manufacturer's and geosynthetic manufacturer's written instructions.
   1. Geotextiles: Completely cover area indicated, overlapping sides and edges a minimum of 4-inches with manufacturer's standard treatment for seams.
      a. Perimeter: Adhere edges on all sides to top of perimeter curb or footing.

3.5 INSTALLATION OF LOOSE-FILL PLAYGROUND SURFACE SYSTEMS

A. Loose-Fill Edgings: Place as indicated, and permanently secure in place and attach to each other according to edging manufacturer's written instructions.

B. Loose Fill: Place playground surface system materials including manufacturer's standard amount of excess material for compacting to required depths after installation of playground equipment support posts and foundations.

C. Compacting and Grading: Uniformly compact and grade loose fill according to manufacturer's written instructions to an even surface free from irregular surface changes as indicated.

D. Install wear mats in areas of high wear, such as slide exits, under swings, and at sliding poles.

E. Finish Grading: Hand rake to a smooth finished surface and to required elevations.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of completed applications of playground surface system shall take place according to ASTM F 1292.

C. Remove and replace applications of playground surface system where test results indicate that it does not comply with requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with requirements.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts and center drop for gates.
4. Manual swing gates and related hardware.
5. Privacy slats at dumpster gates.

B. Related Sections:
1. Section 03 33 00 – Cast-in-Place Concrete: Concrete requirements for fencing footings.

1.2 REFERENCES

A. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
4. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
5. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.

B. Chain Link Fence Manufacturers Institute:
1. CLFMI - Product Manual.

1.3 SYSTEM DESCRIPTION

A. Fence Height: as indicated on Drawings.

B. Line Post Spacing: At intervals not exceeding 10 feet.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

D. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.

E. Manufacturer's Installation Instructions: Submit installation requirements.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 QUALITY ASSURANCE

A. Supply material in accordance with CLFMI - Product Manual.

B. Perform installation in accordance with ASTM F567.

C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates and lock boxes for emergency access.

D. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.2 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years' experience.

B. Installer: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.3 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

1.4 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 7 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

B. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Materials and Components: Conform to CLFMI Product Manual.

B. Fabric: CLFMI Standard Industrial, Residential service.
1. Mesh size: 2 inch.
2. Selvage: Knuckled at both selvages.

C. Intermediate Posts: Type I round.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round.

2.2 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; galvanized steel.

C. Gate Hardware: Fork latch with gravity drop, center gate stop and drop rod, two 180 degree

gate hinges for each leaf, and hardware for padlock keyed to match hardware specified in Section 08 71 00.

D. Base Plate Fasteners: For portions of fencing or gates located on paved areas, provide galvanized pipe flanges at posts that are bolted to concrete paving using 3/8" diameter x 3" series 300 stainless steel expansion bolts and lock washers. Keep bolt holes minimum 3" away from edge of paving to avoid spalling of concrete.

2.3 GATES

A. General:
1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
2. Shop-assemble gates.
3. Design gates for operation by one person.

B. Swing Gates:
1. Fabricate gates to permit 180-degree swing.
2. Gates Construction: ASTM F900 with welded corners. Use of corner fittings is not permitted.

2.4 FINISHES

A. Galvanized Components: Galvanized to ASTM A123/A123M for components; ASTM A153/A153M for hardware; ASTM A392 for fabric; 2.0 oz/sq ft coating.

B. Hardware: Galvanized to ASTM A153/A153M, 2.0 oz/sq ft coating.

C. Vinyl-Coated Components and Fabric: Vinyl coating, black color in accordance with ASTM F934 over specified galvanized coating.

A. Posts, Rails, Frames, and Accessories: Provide manufacturer's powder coat color finish in on all metal exposed to view. The coating material shall be thermoset glycidal-polyester supplied as a homogeneous free-flowing powder applied by electrostatic spray. Cured coating shall be capable of withstanding 500 hours of salt spray without creep when tested according to ASTM B117.
1. Coating shall achieve a dry film thickness of 2 to 4 mils.
2. Color: Match black color of vinyl coated fence fabric.

2.5 PRIVACY SLATS

A. Components: Vinyl strips, flat-faced hollow-core construction with continuous side wings for self-anchoring and nominal 95% privacy closure in a 2" diamond fabric.

B. Basis of Design: *Winged PVC Slats* as manufactured by Hoover Fence www.hooverfence.com.

C. Color: Black color to match vinyl faced fabric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 1 inch above finish grade. Slope top of concrete for water runoff. For posts located on concrete paving, provide galvanized flanges mounted with stainless steel expansion bolts as specified.

C. Line Post Footing Depth Below Finish Grade: ASTM F567.

D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.

E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

F. Install top rail through line post tops and splice with 6 inch long rail sleeves.

G. Install center and bottom brace rail on corner gate leaves.

H. Place fabric on outside of posts and rails.

I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.

J. Position bottom of fabric 2 inches above finished grade.

K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.

L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

M. Install bottom tension wire stretched taut between terminal posts.

N. Support gates from gate posts. Do not attach hinged side of gate from building wall.

O. Install gate with fabric to match fence. Install three hinges on each gate leaf, latch, catches, drop bolt, retainer and locking clamp.

P. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

Q. Install gates with fabric and barbed wire overhang to match fence

R. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.

S. Excavate holes for posts without disturbing underlying materials.

T. Center and align posts. Place concrete around posts and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

U. Allow footings to cure minimum 7 days before installing fabric and other materials attached to posts.

3.2 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: 1/4 inch.

C. Maximum Offset From Indicated Position: 1 inch.

D. Minimum distance from property line: 6 inches.

3.3 PRIVACY SLATS

A. Install privacy slat inserts vertically within open “tunnels” formed by woven wire fence fabric. Ensure side wings are snug with fabric for self-anchoring.

B. Replace any slats that become scuffed, creased or otherwise damaged until accepted by the Owner.

3.4 ADJUSTING AND CLEANING

A. Clean welds, bolted connections, and abraded areas and apply zinc-rich galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 32 31 19 – DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Premanufactured steel fences and swing gates as indicated in the drawings, these specifications, and the approved submittal.

B. Related Sections:
   1. Section 32 31 13 - Chain Link Fences and Gates.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install the steel fencing to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections:
   1. Concentrated load of 400-lb applied at panel mid-span.

1.3 SUBMITTALS

A. Product data for each type of fencing specified, with installation instructions for each unit built-in or connected to other construction. Include methods of installation for each type of substrate.

B. Shop drawings showing installation details of fencing, including full scale installation details of special conditions.
   1. Where installed metal fencing is indicated to comply with certain design loadings, include structural computations, material properties, and other information presenting the complete structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.

C. Samples for initial selection purposes consisting of manufacturer's standard size samples showing full range of colors, textures, and patterns available for each type of fencing and accessory required.

D. Samples representative of materials and finished products as may be requested by Architect.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than 3 years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fencing similar in material, design, and extent to that indicated for this Project.

C. Single Source Responsibility: Provide material produced by a single manufacturer.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fencing must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.8 SEQUENCE AND SCHEDULING

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Sequence outdoor metal fencing installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.9 MAINTENANCE

A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and method which may be detrimental to finishes and performance.

1.10 WARRANTY

A. Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:
   1. Structural failures, including excessive deflection.
   2. Faulty operation.
   3. Deterioration of metals, metal finishes and other materials beyond normal weathering.

B. Warranty Period: 10-years after the date of Substantial Completion.
   1. The warranty shall not deprive the Owner of other rights or remedies the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Ameristar www.ameristarfence.com
   2. Fortress www.fortressfence.com
   3. Substitutions: Section 01 60 00 - Product Requirements.

2.2 METALS

A. Sheet Steel: ASTM A924, yield strength 50,000 psi.
   1. Hot-dip galvanized per ASTM A653, .90 oz/sf coating thickness.

B. Extruded Aluminum: ASTM B221, 6063 alloy, T6 temper; yield strength of 25,000 psi and tensile strength of 30,000 psi.

C. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

D. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

E. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.3 GROUT AND ANCHORING CEMENT

A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include but are not limited to the following:
   1. Nonshrink Nonmetallic Grouts:
      a. "Bonsal Construction Grout"; W.R. Bonsal Co. www.bonsal.com
      b. "Diamond-Crete Grout"; Concrete Service Materials Co.
      c. "Euco N-S Grout"; Euclid Chemical Co. www.euclidchemical.com
      d. "Kemset"; Chem-Masters Corp. www.chemmasters.net
      e. "Crystex"; L & M Construction Chemicals, Inc. www.lmcc.com
      f. "Masterflow 713"; Master Builders. www.masterbuilders.com
      g. "Sealtight 588 Grout"; W.R. Meadows, Inc. www.wrmeadows.com
      h. "Sonogrout"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc. www.chemrex.com/sonneborn/so_abo.htm
      i. "Stoncrete NM1"; Stonhard, Inc. www.stonhard.com

2.4 PAINT

A. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing damaged surfaces in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

2.5 FASTENERS

A. General: Provide zinc-coated fasteners with polymer coating to match the fencing system. Select fasteners for the type, grade, and class required. Equip items with theft-proof fasteners where accessible to tampering.

B. Pop-rivets shall not be used.

C. Base Plate Fasteners: For portions of fencing or gates located on paved areas, provide minimum 24” thickened concrete for 1/4” thick stainless steel base plates and 3/8” diameter x 4” series 300 stainless steel expansion bolts and lock washers. Keep bolt holes minimum 3” away from edge of paving to avoid spalling of concrete.

2.6 COMPONENTS

A. Design Criteria: The drawings indicate the size, profile, layouts, and dimensional requirements of metal fencing work required and are based on the specific types and models indicated. Metal fencing by other manufacturers may be considered, provided deviations in

dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

B. Basis-of-Design - Fence and Swing Gates**:** 3-rail press point Ameristar *Montage Plus* in ***Classic Style***, welded and rackable as manufactured by Ameristar and modified from standard as specified below:
   1. Pattern: Three rails with top and bottom flush rails.
   2. Pickets: 1-inch square steel tube, 14-gage; spaced 4.675 inches o.c., Gate as detailed.
   3. Rails: 1 1/2-inch square steel tube, 14-gage. Gate as detailed.
   4. Fence Posts: Minimum 2-1/2-inch square steel tube, 12-gage minimum.
   5. Post Caps: Pressed point steel.
   6. Swing Gates: Custom gates with removable center mullion, overhead horizontal post brace, self-closing hinges, bottom kick plate, security expanded metal mesh, and lockable exit devices as indicated in the drawings. Manufacturer's standard fully welded gate construction with wrap-around frame hinges, fully pad-lockable fork latch, and cane bolt.
      a. Fully-welded construction to form rigid one-piece unit.
      b. Frame Size: Minimum 2” x 2” x 13 ga.
      c. Rails and pickets: Sizes and spacings same as fence panels.
      d. Bracing: Weld 16 ga. security mesh sufficiently to gate frame to provide diagonal bracing of each gate panel.
      e. Hinges: Self-closing type, *Locinox Mammoth 180* closer and bracket. Provide minimum (2) each leaf for 6 ft. high gates; minimum (3) each leaf for 8 ft. high gates.
      f. Bottom Kick Plate: Provide 16 ga. painted bottom kick plate across full width of gate frame as indicated.

C. Gate Posts: Structural quality galvanized steel tube per ASTM A787, 45,000 psi.
   1. Galvanizing: G90 zinc coated inside and outside. Paint only for inside is not acceptable.
   2. Height above grade: Same as adjacent fencing.
   3. Minimum sizes for up to 8 ft. high fencing: Gate fabricator shall determine actual size and wall thickness requirements for gate posts, but in no case shall posts be less than the following:
      a. Leaf up to 6 ft. wide: 3” x 3” x 12 ga, set minimum 42” in footing.
      b. Leaf over 6 ft. to 12 ft. wide: 6” x 6” x 3/16”, set minimum 48” in footing.
      c. Leaf over 12 ft. to 16 ft. wide: 6” x 6” x 1/4”, set minimum 48” in footing.
      d. Overhead Bracing: Provide minimum 3 x 2”x 16 ga. fully-welded head rail between extended-height posts adjoining a swing gate. Bottom of rail shall provide 81” clear headroom or greater.
      e. Center Mullion: Between a pair of single gates, provide 3” x 2” x 16 ga. removable mullion set in vandal-resistant top and bottom brackets. Top bracket welded to overhead brace, and bottom bracket bolted to minimum 18” deep concrete footing using 3/8” diameter x 3” stainless steel expansion bolts. Set keepers for exit devices within mullion.

2.7 FABRICATION, GENERAL

A. Provide metal fencing and accessory items, both free standing and permanently installed, equipped with functions as specified. Fabricate units with tight seams and joints, exposed metal edges rolled. Manufacturer or product identification on exposed surfaces is unacceptable. Provide products with smooth welds, consistent finish with no evidence of wrinkling, chipping, uneven coloration, dents, or other imperfections.
   1. Pickets, rails, and posts shall be pre-cut to specified lengths. Posts shall be pre-punched to accept rails and fasteners; rails shall be pre-punched and pre-drilled to accept pickets and fasteners.

2. Swing gates shall be fabricated using the same materials as for the complete fencing system. Gate frames shall be made from tubing having the same cross-section as that for the fence rails. Provide number of hinges as recommended by the manufacturer, but in no case less than three hinges per gate.
3. Cantilever gates shall be fabricated of extruded aluminum tracks and pickets, in design compatible with steel fencing. Provide operating hardware and fittings required for complete gate assembly.

2.8 FINISHES

A. Galvanizing: All iron and steel fencing components shall be galvanized. Apply zinc-coating by the hot-dip process in compliance with the following requirements:
1. ASTM A 153 for galvanizing iron and steel hardware.
2. ASTM A 526 for galvanizing all other iron and steel products, with minimum zinc coating weight of 0.60 oz. per square foot (Coating Designation G-60)
3. Provide manufacturer's polyester powder coating on all metal exposed to view. The coating material shall be thermoset glycidal-polyester supplied as a homogeneous free-flowing powder applied by electrostatic spray. Cured coating shall be capable of withstanding 500 hours of salt spray without creep when tested according to ASTM B117. Coating shall achieve a dry film thickness of 2 to 4 mils.
a. Color: As selected by Architect from manufacturer's standard and custom colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing pre-manufactured fencing to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of pre-manufactured fencing. Set fencing accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. 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 the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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 that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.2 INSTALLATION OF PREMANUFACTURED FENCING

A. Adjust fencing prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
   1. Anchor posts in concrete footings designed by the fence/gate system manufacturer's professional engineers, but in no case smaller or less deep than indicated. Provide susbstantial bracing against strong winds until concrete has cured.
   2. For posts located on paved areas, provide mounting plates and bolts as specified elsewhere in these specifications. Provide footings are thickened areas of paving at mounting plate locations. Provide stainless steel shims as required for mounting bolted posts plumb.
   3. Non-shrink, nonmetallic grout:
      a. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8 inch build-up, sloped away from post. Seal anchoring material to comply with grout manufacturer's directions.

3.3 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 32 31 25 – LOUVERED FENCING AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Premanufactured and prefinished aluminum louvered fences and matching swing gates.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install the louvered fencing to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections:
   1. Concentrated load of 400-lb applied at panel mid-span.

1.3 SUBMITTALS

A. Product data for fencing system, with installation instructions for freestanding sections and any portion connected to other construction.

B. Shop drawings showing installation details of fencing, including full scale installation details of special conditions.
   1. Where installed louvered fencing is indicated to comply with certain design loadings, include structural computations, material properties, and other information presenting the complete structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.

C. Samples for color selection purposes consisting of manufacturer's standard size samples showing full range of available.

D. Samples representative of materials and finished products as may be requested by Architect.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than 3-years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of fencing and gates similar in material, design, and extent to that indicated for this Project.

C. Single Source Responsibility: Provide material produced by a single manufacturer.

1.5 PRE-INSTALLATION MEETING

A. Section 01 31 19 – Project Meetings: Schedule and coordinate pre-installation meeting that includes the trade(s) for the work of this Section and other trades that whose work is related to the work of this Section.

B. Convene minimum one week prior to commencing work of this Section.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which louvered fencing must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, and lot number. Store materials in original undamaged packages and containers, inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; stored vertically off ground to prevent damage to material or finish.

B. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.8 SEQUENCE AND SCHEDULING

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Sequence outdoor metal fencing installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.9 MAINTENANCE

A. Maintenance Instructions: Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and method which may be detrimental to finishes and performance.

1.10 WARRANTY

A. Submit a written warranty, executed by the manufacturer, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:
1. Structural failures, including excessive deflection.
2. Faulty operation.
3. Deterioration of metals, metal finishes and other materials beyond normal weathering.

B. Warranty Period: 10-years after the date of Substantial Completion.
1. The warranty shall not deprive the Owner of other rights or remedies the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
1. Anchor Group, inc., www.anchortexas.com
2. Substitutions: Section 01 60 00 - Product Requirements.

2.2 SIZES AND CONFIGURATIONS

A. Design Criteria: The drawings indicate the size, profile, and dimensional requirements of metal fencing work required and are based on the specific types and models indicated. Metal fencing by other manufacturers may be considered, provided deviations in dimensions and profiles are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

2.3 METALS

A. Extruded Aluminum: Alloy 6063 per ASTM B221.

B. Sheet Aluminum: Alloy 6063 per ASTM B221.

C. Steel Sections: ASTM A36/A36M, galvanized

A. Hollow Structural Sections: ASTM A500, Grade B, galvanized

2.4 COMPONENTS

A. Line Posts: Minimum 3” x 3” x 11 ga. galvanized steel tube. Extend 30” into minimum 36” deep x 8” diameter concrete footing.

B. Fence Panel Frames:

1. Slotted Uprights: 2” x 1-1/2” galvanized steel sections; 2 plus center mullion per each panel. Spaced at maximum 72”.

2. Top and Bottom Rails: 2” x 1-1/2” galvanized steel sections.

C. Gate Posts: Minimum 6” x 6” x 9 ga. galvanized steel tube. Extend minimum 42” into minimum 48” deep x 12” diameter concrete footing.

D. Gate Panel Frames:

1. Slotted Uprights: 2-1/4” x 1-1/2” galvanized steel sections; 2 plus center mullion per each panel.
2. Top and Bottom Rails: 2-1/4” x 2-1/4” galvanized steel sections.
3. Bracing: Provide permanent welded diagonal steel bracing rod or tube at each gate leaf from top hinge location diagonally to opposite bottom corner of frame.

E. Louvers: 2” x 1/4” aluminum blades.

F. Hardware:

1. Gate Hinges: Minimum (3) per each gate frame. Minimum (4) for gates 96” or taller. Galvanized.

2. Gate Slide Bolts: Galvanized bolts prepared for Owner padlock.

3. Gate Drop Rods: Minimum 1/2” diameter galvanized rods with brass inserts set in concrete, flush with grade.

4. Fasteners: Galvanized steel.

2.5 FACTORY APPLIED FINISHES: All components shall receive final color polyester finish.

A. Galvanized Steel:
1. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
2. Hot-dip galvanize all items exposed to the exterior, ASTM A123/A123M, minimum 2.0 oz/sq ft coating thickness.
3. Galvanize after fabrication.
4. After galvanizing, fill vent holes and grind smoot.h
5. Galvanizing for Fasteners, Connectors, and Anchors:
   a. Hot-Dipped Galvanizing: ASTM A153/A153M.
   b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

B. Color Finish: Provide manufacturer's polyester powder coating on all metal exposed to view. The coating material shall be thermoset glycidal-polyester supplied as a homogeneous free-flowing powder applied by electrostatic spray. Cured coating shall be capable of withstanding 500 hours of salt spray without creep when tested according to ASTM B117. Coating shall achieve a dry film thickness of 2 to 4 mils.

1. Color: As selected by Architect from manufacturer's standard and custom colors.

1.2 FABRICATION, GENERAL

A. Provide metal fencing and accessory items, both free standing and permanently installed, equipped with functions as specified.

1. Shop-fabricate units with tight seams and joints, exposed metal edges rolled. Manufacturer or product identification on exposed surfaces is unacceptable.

2. Provide products with smooth welds, consistent finish with no evidence of wrinkling, chipping, uneven coloration, dents, or other imperfections.

3. Posts shall be pre-cut to specified lengths.

PART 2 - EXECUTION

2.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

2.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing pre-manufactured fencing to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of pre-manufactured fencing. Set fencing accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Adjust fencing prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction.

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 the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and 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 that no roughness shows after finishing and contour of welded surface matches those adjacent.

2.3 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint (prior to finish coat) to comply with ASTM A 780.

END OF SECTION

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SCOPE

A. The work in this Section includes the installation of all materials specified herein and as shown on the contract drawings required to complete the irrigation system. Work shall include, but not be limited to:

1. Furnishing and installing a complete irrigation system.
2. Permit and fees as per **City of Iowa Colony** regulations.
3. Trenching and backfill.
4. Furnishing and installing backflow prevention devices.
5. Furnishing and installing sleeves where indicated.
6. Coordinate all activities with the installation of related electrical equipment and primary power wiring by electrical subcontractor.
7. Coordinating and installation of water meter and controller according to plans.
8. Boring under existing paving for irrigation piping and control valve wring if additional sleeves are required.
9. Inspections and tests.
10. Install extra control and ground wires if requested by Owners.
11. Clean up and disposal.
12. Coordinate connector of controller inside of building with other trades.
13. Record “As Built” drawings.
14. Warranties.

1.2 RELATED WORK

A. Costs for the following related items shall be part of the irrigation subcontract, unless otherwise specifically arranged for:

1. Contractor is required to obtain all necessary permits and pay all fees prior to any construction.
2. Water meters installation. *(if applicable)*
3. Electrification of controllers, including meters and disconnects.

1.3 RELATED SECTIONS

A. Operation & Maintenance of Planting: Section 32 01 90

B. Turf and Grasses: Section 32 92 00

C. Plants: Section 32 93 00

1.4 COORDINATION OF WORK

A. Contractor is to coordinate with other trades for construction sequence to avoid conflicts.

B. No portion of the irrigation system shall be installed until such time that all mechanical transplanting is complete.

1.5 INSPECTION OF SITE

A. The irrigation contractor shall inspect the site and become familiar with the conditions. Whereas additional site preparation is required prior to irrigation work begin, contractor shall coordinate his portion of the work with all other trades to minimize conflict. The irrigation contractor shall not mobilize his forces until the site is suitably prepared to facilitate the completion of all work in any given portion of the site. Beginning the work of this section without reporting unsuitable conditions to the landscape architect constitutes acceptance of conditions by the contractor. Any required removal, repair, or replacement of this work caused by unsuitable conditions shall be done at no additional cost to owner. Contractor shall take necessary precautions to protect site conditions. Should damage be incurred, this contractor shall repair damaged to its original condition or furnish and install equal replacement at his expense.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety, the Uniform Plumbing Code published by the Western Plumbing Officials' Association, and other applicable laws or regulations including the **City** plumbing code. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the contract document be at variance with the aforementioned rules and regulations, contractor shall notify landscape architect and get his instructions before proceeding with the work affected.

B. Furnish and maintain all warning signs, shoring, barricades, red lanterns, as required by the Safety Orders of the Division of Industrial Safety, and local ordinances.

C. Procure required permits and pay required fees for water meter taps and backflow devices.

D. Arrange inspections as required by local agencies and ordinances during the course of construction.

E. Irrigation in Texas is regulated by the Texas Commission on Environmental Quality (TCEQ) (MC-178) P.O. Box 13087 Austin TX, 78711-3087 www.tceq.state.tx.us

1.7 APPLICABLE STANDARDS

A. Current published standards, specifications, tests or recommended methods of trade, industry, or governmental organizations apply to work of this Section where cited by abbreviations noted below:

1. American Society of Testing and Materials (ASTM)

1.8 SUBMITTALS

A. At least ten (10) days prior to beginning work, submit five (5) copies of manufacturer's current cata- log cuts, specifications, and operating instructions of the complete list of materials and assemblies to be installed. Quantities of materials and equipment need not be included.

1.9 SUBSTITUTIONS

A. Specific reference to manufacturers' names and products specified in this section are used as standards. This implies no right to substitute other material or methods, without written approval of the landscape architect. No substitutions should be used as a basis for bid unless otherwise allowed and authorized by bid addendum, prior to receipt of bids.

1.10 SCHEDULING

A. If requested, contractor shall submit a proposed work schedule to landscape architect at least ten (10) days prior to start of work under this section. After approval, no delays shall be authorized to this schedule without written authorization by landscape architect.

B. The contractor shall complete all irrigation and related electrical work and have complete irrigation system installed prior to the commencement of any planting.

C. Upon approval from landscape architect, the contractor may be release of partial areas where irrigation is complete and automated for commencement of planting operations.

1.11 PRODUCT HANDLING

A. Protect work and materials under this section from damage during construction and storage. Protect pipes and fittings from direct sunlight. Beds on which pipe is stored shall be the full length of the pipes. Do not use any pipe or fitting which has been damaged or dented.

1.12 RECORD IRRIGATION DRAWINGS

A. Contractor shall furnish record drawings of the complete irrigation system, in accordance with the General Conditions. Procure from the landscape architect full-sized copies of contract drawings. Construction drawings shall be on the construction site at all times while the irrigation system is being installed. Contractor shall make a daily record of all work installed during each day.

B. Drawings shall show approved substitutions, if any, of material, including manufacturer's name and catalog number. The drawings shall be made to scale and all indications shall be neat. All information noted from the field shall be transferred to the drawings by contractor, and all indication shall be recorded in a neat, orderly way.

C. Final record drawings shall contain the following information:

1. Actual location of specified valves, added new valves, quick couplers, moisture sensor, rerouted lateral line locations, rain sensor and mini weather station. If requested by land- scape architect, provide dimensions from easily identified permanent features, such as buildings, curbs, fences, walks or property lines to each of the listed elements.

2. Each zone shall be outline with either thick marker or color pen. Each outlined zone must be properly label with zone number.

D. The record drawings shall be turned over to the owner and landscape architect before the final acceptance of the project.

1.13 IRRIGATOR LICENSE

A. All works in this section shall be performed under the direct supervision of a Texas licensed irrigator.

1.14 REVIEWS AND TESTS

A. The contractor shall test lines under hydrostatic (line) pressure for a 12-hour period and repair any leaks as required by the landscape architect.

B. Final review shall be made in conjunction with the final review of lawn, shrub and tree planting.

C. The contractor shall be responsible for making all repairs required to the irrigation system until the issuance of the Certificate of Substantial Completion. Upon the issuance of the Certificate, the owner shall assume responsibility for the repair and maintenance of the irrigation system.

D. All hydrostatic testing required in this section shall be at the contractor's expense, and part of this contract.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials and equipment to be installed shall be **new, of current manufacture, and the best of their respective kinds**. All materials must conform to Alvin ISD standards and specifications.

B. All controllers shall be **Rain Bird ESP-LXD** models equipped with **Flow Smart modules**, installed as Follows:

1. The main irrigation controller shall be located in the **Main Mechanical Room**.
2. The athletic field irrigation controller shall be installed **under the bleachers**.
3. The irrigation system shall utilize a **2-wire system** with an **IQ Ethernet cartridge** (wireless not permitted).
4. A **data drop (Ethernet cable)** shall be provided to each controller location.
5. A **Rain Bird WR2 wireless rain/freeze sensor** shall be included. Final location to be confirmed by Owner.

2.1 PIPE

A. All piping shall be Schedule 40 PVC throughout the system, except for threaded fittings which shall be Schedule 80 PVC.

B. Class 200 pipe is not permitted.

C. Pipe from the water source through shut-off valves, backflow device, flow sensor, and master valve shall be Schedule 80 PVC.

D. All pipes shall be permanently marked with the manufacturer’s name, pipe size, schedule, pressure rating at 73°F, and NSF approval.

E. Minimum separation between pipes in trenches shall be 12 inches.

F. Pipes may not be stacked vertically, except at intersections or required crossings.

G. All trenches shall be backfilled with clean bank sand, providing 2 inches below and 4 inches above the pipe.

H. Backflow prevention shall be Febco 765 PVB or Watts LF-909 RPV, installed with a security cage and pipe insulation on all exposed segments.

I. Provide isolation valves, master valve, and flow sensor as required by system layout.

J. All valve boxes shall include:

1. Rectangle boxes with one common brick under each corner.
2. Round boxes with two common bricks.
3. Gravel base inside box, per standard detail.
4. Bolted covers for security.

K. 6” pop-up heads shall be used in turf areas; minimum 4” pop-ups required where heads are adjacent to paved edges.

L. Trees in sod shall receive one (1) 0.5 GPM bubbler, located at the root ball below the mulch. Trees in hydromulch shall receive two (2) bubblers.

M. All sleeves shall be marked with an “X” on the curb for field identification.

2.2 FITTINGS

A. Fittings for Rubber-Gasketed Pipe

1. Connections at 3" and 4" mains to 3" and 4" mains or laterals shall be Schedule 80, as provided by the same manufacturer as the pipe, and conforming to ASTM D-2466 and ASTM D-1869.
2. Connections at 3" and 4" mains to 2 1/2" and smaller mains and laterals to remote-control and quick-coupling valves shall be Schedule 40 solvent-weld socket fittings conforming to ASTM-2466.

B. Fittings for Solvent-Welded Pipe

1. Schedule 40, polyvinyl chloride, standard weight, as manufactured by "Sloane", "Lasco", or approved equal, to meet ASTM D-2466-73 and D-2467-73.
2. Threaded PVC nipples shall be Schedule 80 PVC.
3. Solvent glue shall be "Christy's Red Hot Blue Glue" with compatible primer.

C. Fittings for Polyethylene Pipe (Flex-Joints)

1. Polyalomer, as manufactured by "Flintkote" or approved equal.
2. Compression type of COVC, as manufactured by "Pepco" or equal.

D. Fittings for Sprinkler Swing Joints

1. Supply two (2) Schedule 40 "Marlex" street elbows and one (1) Schedule 40 thread-to-thread.

2. Threaded PVC Nipples shall be Schedule 80 PVC.

3. Lengths of nipples as shown on plans.

E. Fittings for Quick Coupler Swing Joints (Schedule 40)

1. Supply three (3) galvanized thread-to-thread elbows

2. Two (2) three inch (3") galvanized nipples

3. One two inch (2") threaded galvanized nipple

4. One twelve inch (12") threaded galvanized nipple

5. Use "Permatex" pipe compound for all threaded fittings

6. Eighteen-inch (18") #5 rebars

7. Two (2) stainless steel hose clamps

2.3 GATE VALVES

A. Up to three- inch (3"):125 lb. bronze construction, non-rising, as manufactured by "Grinnel", Red and White, or approved equal

2.4 SLEEVES FOR CONTROL WIRES AND WATER LINE

A. All conduits and sleeves for irrigation mains and laterals shall be six-inch (6") Schedule 40 PVC common conduit, unless indicated otherwise in the contract drawings. Use two-inch (2") Schedule 40 PVC for remote control wiring. For controller power feed, use 3/4" galvanized steel, unless otherwise specified on the drawings or existing in the field.

2.5 CONTROL WIRE

A. Wire

1. Solid copper wire, U.L. approved for direct burial in ground.

2. Minimum gauge: #14 U.F.

3. Common ground wire shall be white.

B. Extra Wire

1. Supply a minimum of one (1) extra wire for each direction of run to last valve.

2. Extra wire shall be of a fugitive color, loop at each valve.

C. Splicing Material

1. All wiring splicing material shall be 3M DBY/DBR and DBY-6/DBR/6 Direct Bury Splice Kits.

2. All wire splice shall be placed in a 10” circular box.

2.6 VALVE BOXES

A. Valve boxes shall be injection-molded of polyesters and fibrous inorganic, temperature-resistant components. Box shall provide adequate clearance to operate and service valve. Box and lid to be green (purple if reclaimed water), as manufactured by Carson Industries, Inc., LaVerne, California or approved equal.

1. Electric Valve Boxes shall be rectangular, approximately ten inches by fourteen inches (10" x 14") and shall be approximately fifteen inches (15") deep. Model #1419-12 with 1419-2 hinged cover. Extensions for rectangular boxes shall be Carson #1419E-12 or Ametek or approved equal.

2. Gate Valve shall be round, approximately nine inches (9") inside diameter by ten inches (10") deep. Model #910-12. Extensions for round boxes shall be Carson #910E-12 or Ametek or approved equal.

2.7 QUICK-COUPLING VALVES / HOSE END CONNECTIONS

A. Valve and key shall **see plans legend for manufacturer and model**.

B. Hose connectors shall be NIBCO # or approved equal.

C. Furnish two (2) valve keys fitted with three-quarter inch (3/4") swivel hose ells.

D. Quick coupling valve box shall be 10"x14" to access ball valve easily.

E. All quick coupling valve caps shall be purple color as required by TCEQ regulations.

F. All quick coupling valve caps shall have a ball valve as required by TCEQ.

G. All quick coupling valve caps shall have a tag stating non potable water.

2.8 CONTROL WIRE SPLICE BOXES

A. Shall be ten inches (10") in diameter by ten inches (10") deep**. Rainbird or Owner approval equivalent.**

2.9 DRIP SYSTEM

A. See plans legend for manufacturer and model.

B. 1-inch Control Zone Kit: See plans legend for manufacturer and model.

2.10 REMOTE CONTROL VALVES

A. Valves shall be of plastic construction, slow acting **"Rainbird" ESP-LXD or approved equal**. Use PRS regulators where shown on plans.

2.11 REMOTE CONTROL TAGS

A. "Christy Irrigation I.D. Tags", yellow, with thermofused numbers with letter prefixes to match controller letters

2.12 VALVE KEYS

A. “Champion" #30, thirty inches (30") long, or approved equal. Furnish two (2) keys.CONTROLLER

B. All controllers shall be positively grounded to a three-quarter inch (3/4") copper rod, driven a mini- mum of forty-two inches (42") into the ground. All units shall come equipped from the manufacturer with complete lighting and power surge protection.

C. See plans legend for Manufacturer and Model.

2.13 MOISTURE SENSOR (REFERENCE ONLY)

A. All moisture sensors shall be located within a 3’ diameter of the wire splice circular box so that they are easy to locate.

B. See plans legend for Manufacturer and Model.

2.14 CONCRETE FOR THRUST BLOCKS

A. Portland Cement

1. Shall conform to current requirements of ASTM Designation C150, Type I or IIcement.

B. Coarse Aggregate

1. Coarse aggregate for regular-weight concrete shall be hard, durable, uncoated, washed, graded, cleaned and screened crushed rock or gravel, conforming to current requirements of ASTM Designation C33.

C. Concrete shall be designated to surpass compressive strength of 3,000 psi.

2.15 GRAVEL BACKFILL

A. Gravel for backfilling quick-couplers, remote control valve boxes and rotor heads shall be three-eighths inch (3/8") diameter "pea gravel".

PART 3 - EXECUTION

3.1 LAYOUT

A. No consideration shall be given to any design changes until after the awarding of the contract. Should any changes be deemed necessary after award of contract for proper installation and operation of the system, such changes shall be negotiated by the landscape architect, based upon the price schedule.

B. Sprinkler heads shown on the drawings are diagrammatic. It shall be the Contractor's responsibility to establish the location of all sprinkler heads on all turf areas, in order to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on the

drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of rejection.

C. The Contractor will stake out the location of each run of pipe and all sprinkler heads for sprinkler valve locations, prior to trenching. If any given area requires changes due to field conditions, contractor shall contact landscape architect for an alternative location. Do not re-route without consulting landscape architect as it might create conflicts with other field elements. Proposed new location shall be approved by landscape architect prior to installation. Otherwise, it is contractor's sole responsibility for all relocation cost and at no cost to the owner.

3.2 PREPARATION

A. Generally, all piping under concrete and special paving shall be Schedule 40 PVC. Piping under concrete or asphalt shall be installed by boring. Where any cutting or breaking of sidewalks, concrete work and/or asphalt is necessary, it shall be removed and replaced by the contractor as part of this contract, in accordance with the owner and/or landscape architects' direction, at no cost to the owner. Where piping on the drawings is shown under paved areas but running parallel and adjacent to planted areas or turf areas, the intent of the drawings is to install the piping in the planted turf areas.

B. Unless otherwise specified or indicated on the drawings, the construction of the sprinkler system shall include the furnishing, installing, and testing of all mains, laterals, risers and fittings, the furnishing and installing of sprinkler heads, control valves and all necessary specialties and accessories, the removal and/or restoration of existing improvements, excavation and backfill, and all other work in accordance with the plans and specifications, as required for a complete system.

3.3 EXCAVATING AND TRENCHING

A. In areas where electrical conduit will be installed by the electrical contractor, coordinate all trenching activities with electrical subcontractor, so as to minimize duplication of work and/or damage to other's work.

B. Perform all excavations as required, for installation of work included under this section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground installations, damaged or cut as a result of the excavations, to their original conditions.

C. The exact location of all existing utilities and structures and/or underground utilities, which may not be indicated on the drawings, shall be determined by the contractor and indicated on the "as built" drawings as they are encountered. The contractor shall conduct his work so as to prevent interruption of service or damage to them

D. In cases where existing underground utilities cannot be verified, it is contractor's responsibility to contact the proper agencies for a field location check.

E. The contractor shall protect existing structures and utility services and be responsible for their re- placement if damaged by him, or make necessary adjustments in their location if required, in order to complete the work of this contract. Minor adjustments in the system will be permitted to clear existing fixed obstructions, subject to the approval of the owner's representative or the landscape architect.

F. Trenches for plastic pipe shall be excavated of sufficient depth (12" to top of pipe) and width to

permit handling and installation of the pipe and fittings. The backfill shall be thoroughly compacted by water tamping or approved method and evened off with the adjacent soil level. All trenches that are opened during any particular working day shall be closed and backfilled the same day. No open trenches or partially backfilled trenches shall be left overnight, except as required for inspection.

G. Trenches shall be of sufficient depth to provide minimum cover from finish grade, as follows:
1. Over pipe, on pressure side of irrigation control valve, control wires and quick coupling valves: twenty inches (20”) minimum.
2. Over pipe, on non-pressure side of irrigation control valve: twelve inches (12”) typical.

3.4 BORING METHOD

A. All borings shall be performed with a water-lubricated rotary machine.

B. All bores shall be a minimum of eighteen inches (18") below any pavement, or at a depth required by governing code.

C. For bores greater than two inches (2"), a maximum pilot diameter of two inches (2") shall be used, with reamers for larger bores at a maximum of two-inch (2") increments.

D. Sleeves shall be immediately installed, as part of the boring operation.

E. Insert pull strings in sleeves as necessary.

F. Provide shoring, if required, to eliminate subsidence from under pavement structures.

G. Report any irregularities and obstructions in the boring process to the landscape architect for alternate route.

3.5 WATER METERS

A. Make required connections to water meter per the requirements of the local water authority codes.

3.6 BACKFLOW PREVENTION DEVICES

A. Install pressure-type backflow preventer at required grade for plumbing code. All exposed main line and main line riser above PVC main elevation, shall be type "K" copper. Install one (1) brass union in riser downstream, or device. Wrap all controllers with foam-type insulators.

B. See plans legend for Manufacturer and Model.

C. Backflow prevention devices shall be enclosed with metal enclosure as per detail.

D. Contractor shall provide inspection approval certificate from local agencies to owner and landscape architect before the final acceptance of this project.

3.7 LINE INSTALLATION

A. All pipe, fittings, and valves shall be carefully placed in the trenches. Interiors of pipe shall be kept free from dirt and debris. When pipe lying is not in progress, open ends of pipe shall be closed by approved means.

B. All lateral connections to the mainline, as well as all other connections shall be made to the side of the mainline pipe. No connections to the tip of the line shall be allowed. Pipes shall be bedded in at least two inches (2") of finely divided material with no rocks or clods over one-inch (1") diameter, to provide a uniform bearing. In common trenches, do not allow pipe to overlap.

C. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction, as recommended by the manufacturer.

D. Plastic pipe shall be cut with PVC pipe cutters or hacksaw, or in a manner as to ensure a square cut. Burrs at cut ends shall be removed prior to installation, so that a smooth, unobstructed flow will be obtained.

E. All plastic-to-plastic joints, except polyethylene, shall be solvent-weld joints or slip-seal joints.

F. Shall be made with plastic male adaptors.

3.8 SOLVENT-WELD JOINTS FOR PLASTIC PIPES

A. Thoroughly clean the mating pipe and fitting with a clean, dry cloth.

B. Apply a uniform coat of primer to the outside of the pipe and the fitting.

C. Apply a uniform coat of solvent to the outside of the pipe first, and then inside the fitting. Apply a second coat of solvent to the outside of the pipe, and quickly insert it into the fitting.

D. Give the pipe or fitting a quarter turn to ensure even distribution of the solvent, and make sure the pipe is inserted to the full depth of fitting socket.

E. Hold in position for fifteen (15) seconds.

F. Wipe off excess solvent that appears at the outer shoulder of the fitting. Care should be taken so as not to use an excess amount of solvent, causing an obstruction to form on the inside of the pipe. The joints shall be allowed to set at least twelve (12) hours.

G. Use "Permatex" pipe compound on the threaded PVC fittings, except where Marlex fittings are used.

H. Use strap-type friction wrench only. Do not use metal-jawed wrench.

I. When connection is plastic-to-metal, male adaptors shall be used. The male adaptor shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or equal, upon approval.

3.9 CONCRETE THRUST BLOCKS

A. Install where the rubber-gasketed irrigation main changes direction, as at ells and tees, and where the rubber-gasketed main terminates.

B. Pressure tests shall not be made for a period of thirty-six to forty-eight (36-48) hours following the completion of pouring the blocks.

C. Blocks for these mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications. Blocks shall be placed to take all thrust created by the maximum internal water pressure.

3.10 REMOTE CONTROL VALVES

A. Unless otherwise specified, the installation of all valves shall include the excavation and backfill, the furnishing, installing and testing of risers, fittings and valves, and the removal and/or restoration of existing improvements, and all other work, in accordance with the plans and specifications, and as required for the completed installation.

B. Valve installation shall include setting of the specified valve box to proposed grade. All valves shall be teed off the main, to facilitate setting at six inches (6") below grade, measured at the top of the handle.

C. Install control valves in valve boxes where shown, and group together, where practical. Place no closer than eighteen inches (18") to walk edges, buildings and walls. Valve boxes shall be flush with finished grade and fill ground with 3” to 4” of pea gravel. Set all remote control boxes in centerline of median for all esplanade applications.

D. Set valves in bead of four inches (4") of pea gravel, and fill to half of valve body.

3.11 SPRINKLER INSTALLATION

A. Sprinkler heads shown on the drawings are diagrammatic. In some cases, landscape architect may deem it is necessary to adjust or add spray heads in the field to improve coverage, avoid vertical elements, or spray patterns were infringes by plants. If such an adjustment and additional items are necessary and the works are relatively minor, contactor shall expect to make field changes with no cost to the owner.

B. All sprinkler heads and quick-coupling valves shall be set perpendicular to finished grade, unless otherwise designated on the drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas shall be set to grade no closer than eighteen inches (18") from such walls. Sprinkler heads which are to be installed in lawn areas where the turf is not yet established shall be set one-half inch (1/2") above the proposed finish grade.

C. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by the contractor as part of the original contract, with no additional cost to owner. All sprinklers having an adjusting screw shall be adjusted on a lateral line or circuit, as required, for the proper arc of cover- age, radius, diameter and/or gallonage discharge.

D. Backfill all rotor heads having drain holes in body with a minimum of one-half cubic foot (1/2 c.f.) of pea gravel.

E. After all new sprinkler piping and risers are in place and connected, and all necessary division work has been completed, and prior to the installation of sprinkler heads, all control valves shall be opened, and a full head of water used to flush out the system. The same procedures shall apply to the polyethylene tubing. Testing of the system shall be performed after completion of each section.

3.12 AUTOMATIC CONTROLLER

A. Install specified units in specified enclosures.

B. Install per local code and manufacturer's latest printed instructions.

C. Connect remote control valves to controller in clockwise sequence to correspond with station setting, beginning with stations 1, 2, 3 and so on.

D. All controllers shall be fully grounded and have full manufacturer-approved lightening protection.

E. It is contractor responsibility to coordinates with general contract to provide electricity to the vicinity of the controller. Contracts shall contract with a state licensed electrician to hook up power to controllers. Hard wiring for controller is required. Under no circumstance controller to be connect to wall plug.

1. Wall plug connection for the controller can only be used as temporary electricity supply during construction if necessary, for test run. Once the system is fully operational, contractor shall rewire the controller immediately and connect to a permanent power supply by hard wire.

3.13 QUICK COUPLER

A. Pre-assemble quick coupler swing joint, using brass nipples and fittings as shown on details. Use Teflon tape for all threaded joints.

B. Discard nipples and fittings with damaged threads.

C. Test swing joint and quick coupler by pressuring to specified main line pressure. All joints should withstand pressure, while still being flexible.

D. Glue pre-assembled quick coupler and swing joint to main line and stack quick coupler, as shown.

E. Stake quick coupler assembly with specified rebar and two (2) hose clamps.

F. Install specified nine-inch (9") round box and pea gravel. Top of quick coupler shall be four inch (4") below top of box. Fill box with pea gravel to six inches (6") below top of box.

3.14 SPRINKLER SWING JOINTS

A. Install swing joints, as shown on drawings.

B. All joints shall be hand-tightened to eliminate leakage, but loose enough to remain flexible.

C. All pipe and fittings shall be oriented on either a horizontal or vertical access.

D. When complete, the heads should be fully adjustable.

E. Where possible, make all connections to the bottom of the sprinkler body. Avoid side connections, except for planter box applications.

F. All head height adjustment shall be made through the swing joint. When adjusted to grade, sufficient adjustment shall remain to facilitate raising or lowering at a later date.

3.15 CONTROL WIRES

A. Install control wires with sprinkler mains and laterals in common trenches, wherever possible. Lay to the side of pipe lines. Snake wires in trench, to allow for contraction of wires. Tie wires in bundles at ten foots (10') intervals with 3/4" black electrician tape.

B. Control wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than five hundred feet (500'). Splice each connection in a separate "Scotchlock Sealing Pack". Place all splices in nine inches (9")

diameter boxes.

C. Coil control wires and extra wires at each R.V.C. connection. Coil by neatly wrapping wire around a section of pipe, ten (10) wraps before splicing. Similarly coil all control wires at each end of all sleeves and where wire changes direction.

D. Install a minimum of one (1) extra control wire to the control valve located the greatest distance from the controller in each direction and label each blank end.

E. Pilot Wires to be red or black and white to be for all common ground wires.

3.16 GATE VALVES

A. Install isolation and branch gate valves directly on main.

B. Where gate valves isolate branch mains of a smaller size, size valve to largest main and add reducing fittings down stream of valves.

C. Place gate valve on minimum of four inches (4") of pea gravel. Place to cover pipe, while leaving handle fully exposed.

D. Install specified "Carson" box and "Carson" extension over valve. Box and extensions should extend from finished grade to top of pipe.

3.17 CONDUITS AND SLEEVES

A. Furnish and install conduit where control wires pass under or through curbs.

B. Conduits to be of adequate size to accommodate retrieval for repair of wiring and shall extend twenty-four inches (24") beyond edge of walls. Minimum size shall be four inches (4").

C. Install sleeves for all pipes passing through or under walls, walks, and paving. Sleeving to be of adequate size to accommodate retrieval for repair and wiring, or piping, and shall extend twelve inches (12") beyond edge of paving or other construction, where possible. Minimum size shall be six inches (6"). Refer to sleeving plan for location and sizes.

3.18 TESTING

A. Test piping on the non-pressure side of control valves after system is operational, by observing for leaks in pipe trenches.

B. Leaks resulting from tests shall be repaired, and tests repeated until system passes tests.

C. Completely install meter, mains, control valves and isolation valves.

D. Fill all lines with water and shut off at backflow.

E. Open all isolation valves.

F. Pressurize main to approximately 125 PSI. Monitor gauge for pressure for four (4) hours, with a maximum allowable loss of one (1) PSI per hour. Pressurize at quick coupler or fabricate a fitting for this purpose.

G. Repair any leaks or sources of pressure loss.

H. Test all isolation valves for leakage.

I. Perform above test prior to operation of laterals.

J. Laterals to be visually inspected for leaks during operation.

3.19 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches with clean soil, free of debris.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95% density under pavements, 85% under planted areas.

C. Compact trenches in areas to be planted, by thoroughly flooding the backfill. Jetting process may be used on those areas.

D. Dress off all areas to finish grades.

3.20 CLEAN UP

A. Keep all areas of work clean, neat and orderly at all times. Keep paved areas clean during installation. Clean up and remove all debris from the entire work area to the satisfaction of owner and landscape architect prior to Final Acceptance.

3.21 EXTRA MATERIALS

A. The Contractor shall provide the following extra parts as part of this contract, prior to Final Acceptance.

ITEM	QUANTITY
Quick Couplers	2
Gate Valve Box	2
Quick Coupler Box Covers	2
R.C.V. Box	2
Sprinkler Heads	2 of each type used
Quick Coupler Keys	2
Thompson Keys	2
Valve Cover Keys	2 of each type used

3.22 WARRANTY

A. In addition to manufacturer's guarantees or warranties, all work shall be warranted for one (1) year from the date of Substantial Completion against defects in material, equipment and workmanship by the contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment, and workmanship, to the satisfaction of the owner. This shall not be interpreted to include damage caused by vandal- ism, accident or the result of activities by other parties.

B. The irrigation Contractor shall submit a letter of warranty, through the prime contractor, containing the following paragraph:

> "We hereby guarantee that the sprinkler irrigation system that we have furnished and installed is free from defects in materials and workmanship. The work has been completed in accordance with the drawings and specifications, ordinary wear and tear and/or unusual abuse or neglect, excepted. We agree to repair or replace any defects in material or workmanship which may develop during the period of one year from the

date of acceptance, and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the owner. We shall make such repairs or replacements within a reasonable time, as determined by the owner, after receipt of replacements within a reasonable time, after receipt of written notice by Certified Mail from the owner, we authorize the owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand."

END OF SECTION 32 84 00

SECTION 32 91 13 – SOIL PREPARATION

1.1 GENERAL

1.2 Work included in this Section shall include, but not be limited to, the following:

A. Project Layout

B. Preparation of existing rough grade for deposition of fine grading materials and turf

C. Cleanup and removal of debris and material, labor, tools, machinery and processes necessary to complete the above.

1.3 All work under this Contract not specifically designated on the drawings shall be field directed by the Owner or their Agent.

1.4 The use of any area for the purposes of equipment access, storage and employee parking shall be subject to the approval of the Owner or their Agent and in accordance with Division I. Prior to the start of any work, the Contractor shall submit a site plan clearly showing all access points, storage areas, employee parking areas and temporary facilities for approval by the Owner or their Agent.

1.5 WORK INCLUDED

A. Clearing and grubbing required for this Work includes, but is not necessarily limited to:

1. Felling of trees including removal of stumps, roots, and other debris.

2. Removing shrubs, grass, weeds, and other understory vegetation.

3. Removing improvements or obstructions that interfere with new construction.

4. Construction of temporary barriers around trees and/or tree save areas designated to remain.

5. Removal of all debris.

6. Siltation fence maintenance and installation.

PART 2 – MATERIALS

2.1 The Contractor shall submit an outline of methods, materials and machinery to be employed to complete work in this Section for approval.

2.2 HERBICIDE

A. Round Up or approved equal.

2.3 BARRICADES

A. 48" orange snow fencing or equal.

B. 5' metal "T" posts

2.4 SILTATION FENCING

A. 18" Mirafi 400 or equal.

PART 3 – EXECUTION

3.1 All work shall be performed under the direct supervision of the Contractor's designated superintendent. The above shall apply to all work, whether performed by the Contractor's own forces or sub-contractors.

3.2 SITE INSPECTION

A. The drawings do not purport to show all objects existing on the site.

B. Before commencing the work of this Section, verify with the Owner or their Agent all objects to be removed and all objects to be preserved.

C. Locate all existing utility lines and determine all requirements for disconnecting, abandonment, and capping. Assistance in the location of all existing utilities can be obtained from the Utility Coordinating Committee for The city of Iowa Colony.

D. Locate all existing active utility lines traversing or adjacent to the site, and determine the requirements for their protection.

E. Attention is called to Division I requirements for protection of existing utilities and for reporting utilities not shown in plan.

3.3 REMOVAL OF DEBRIS

A. Remove all debris from the site and leave the site in a neat and orderly condition to the Approval of the Owner or their Agent.

B. All debris, the product of demolition, clearing, etc. unless otherwise designated, shall be removed from the site and legally disposed of. Such debris will not be allowed to accumulate so as not to constitute a hazard to the public.

C. Debris shall include all barricades or fencing and silt fencing upon completion of their intended use.

3.4 PREPARATION OF AREAS TO RECEIVE FILL MATERIAL

A. Treat all existing vegetative areas with Round Up and allow 7 - 10 days for effect.

B. Remove all dead vegetation.

C. Scarify top 4" of existing soil.

D. Apply till material.

3.5 TREE BARRICADE FENCING

A. Install 48" orange snow fencing continuously around all forested areas which are to remain undisturbed within the site as well as those isolated individual trees to remain.

B. Repair as necessary during the course of the work to keep areas free of intrusion by machinery, materials, equipment and workmen.

3.6 SILTATION FENCING

A. Install specified fencing at all curbs, property lines and edges of undisturbed forested areas to

enclose the perimeter adjacent to all disturbed areas.

B. Fence shall be installed so as to prevent the migration of silt onto streets and adjacent properties and undisturbed forested areas.

3.7 CLEARING AND GRUBBING *(FOR REFERENCE ONLY)*

A. Felling of Trees

1. Protect roots and branches of trees designated to remain.

2. Remove only trees and shrubs within clearing areas designated on the drawings unless otherwise indicated or directed.

3. Completely remove stumps, root and other debris protruding through ground surface to a minimum depth of 12 inches.

4. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

B. Grubbing

1. Remove all surface rocks, stumps, roots and other vegetation within limits of construction to a minimum depth of 6".

2. Do not leave any roots greater than 3 inches in diameter in the ground.

3.8 STRIPPING TOPSOIL *(FOR REFERENCE ONLY)*

A. Strip to whatever depths encountered in such a manner to prevent intermingling with underlying subsoil or other objectionable material.

B. Remove heavy growths of vegetation from areas before stripping.

C. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance from trees to prevent damage to main root system.

D. Stock pile topsoil where directed.

E. Construction storage piles to freely drain surface water.

F. Cover storage piles if required to prevent windblown dust.

END OF SECTION 32 91 19

SECTION 329114 – PLANTING MEDIA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide materials, testing, equipment and labor required to prepare amended plant mediums for:

1. Planting Backfill Mix
2. Tree Planting Pit Backfill Mix
3. Shrub Bed Planting Backfill Mix

1.2 RELATED SECTION

A. Planting: Section 32 93 00

1.3 QUALITY ASSURANCE

A. If requested by owner, all soil components shall be tested by local or state testing laboratory for conformity to the specifications:

1. Contractor shall submit proposed laboratory name, address, and telephone numbers for approval.

B. For delivered material, test one grab sample for each 100 cy. of bulk material delivered to the site.

C. Excavated material from tree pits and shrub beds shall not be used for preparation of backfill mix.

1.4 SUBMITTALS

A. Contractor shall submit small bags of soil samples and mulch to landscape architect for approval prior to delivery to the job site.

B. Planting media mix data from manufacturer.

C. Manufacturer’s product data information.

1.5 INSPECTIONS

A. Testing will be at the expense of the contractor.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material to site when permitted by the owner and only when project is ready for related work.

PART 2 – MATERIALS

2.1 ON SITE MATERIALS

A. Specified backfill mixes shall consist of like material to that used for landscape grading.

2.2 SOIL AMENDMENTS

A. Wood Residuals

1. Shall be naturally composted stockpiled, and not have been chemically treated.

2. Physical Properties

a. Grading:

U.S. Sieve	Dry Weight Percent Passing
3/8	100
1/4"	90-100
No. 8	70-100
No. 35	0-30

b. Organic Content by Ash Analysis: 90-100% Dry Weight

c. Chemistry

1) Saturation Extract

Conductivity (EDc): Nil-3.5

2) Reaction (pH): 3.0-5.5

d. Salinity

3) Maximum saturation extracts conductivity 1.0 milliohms per cm at 25 degrees centigrade.

B. Sand

1. Physical Properties

a. Grading:

U.S. Sieve	Percent Passing
No. 4	100
No. 10	95-100
No. 18	90-100
No. 35	65-100
No. 60	0-50
No. 140	0-20
No. 270	0-7

b. Chemistry:

Saturation

Extract

Conductivity (EDC):	Nil-3.0
Sodium Absorption Ratio (SAR):	Nil-6.0
Boron-ppm in saturation extract sltn.:	Nil-1.0
Reaction (pH):	6.0-7.5
Available calcium-sodium acetate extractable-ppm dry weight:	Nil-2000

c. Iron Sulfate (Ferric or Ferrous)

1) Shall contain 30 to 35% iron, 35-40% Sulphur and be supplied by a commercial fertilizer supplier.

d. Treble Superphosphate

1) Commercial product containing 19 to 20% available phosphoric acid.

e. Urea Formaldehyde

1) Commercial product containing 38% Nitrogen

f. Soil Sulphur

1) Agricultural grade Sulphur containing a minimum of 96% Sulphur.

g. Ammonium Sulfate

1) Commercial product containing approximately 21% ammonia.

2.3 PLANTING MIX

A. Planting mix shall be thoroughly mixed in the following proportions:

1. Tree planting, shrub Bed, and planter backfill mixes:

a. Contain sandy loam topsoil

b. Double ground aged rice hull compost

c. #1 bank sand

d. Growers grade pine bark

e. Forest floor mulch (Black Humus)

f. All material is screened to provide 99% 1” minus sizing then blended to provide a uniform mixture. A minimum of 40% composted organic are utilized to add natural nutrients, provide aeration and optimum moisture retention capacities.

B. Actual mixes and additive may vary depending on samples extracted from actual plant sources.

C. Mulch shall be “Native Hardwood” mulch as supplied by Nature’s Way Resources, 101 Sherbrook Circle, Conroe, Texas 77385, 936-321-6990 or approved equal.

D. Prepared backfill mixes shall come from the following source or other reputable source:

1. Living Earth Technology, Houston, Texas (713) 466-7360 Select the branch that is closest to the job site

2. Nature's Way Resources, Conroe, Texas (936) 321-1200 101 Sherbrook Circle, Conroe, Texas 77385

3. Reputable local suppliers, contractor to submit venders for approval.

E. All shrubs beds shall receive one application of post planting fertilization with Microlife Ultimate (8-4-6) as supplied by San Jacinto Environmental Supplies, 2221 W 34th St., Houston, Texas 77018, 713.57.9090.or approved equal.

F. If root stimulator is required after planting, apply one application of "Super Seaweed" as supplied by San Jacinto Environmental Supplies, 2221 W 34th St., Houston, Texas 77018, 713.57.9090 or approved equal.

PART 3 - EXECUTION

3.1 MIXING

A. Mix soil base, amendments and chemical additives by mechanical means. Do not mix additives with excavated material at the plant pit site

B. Thoroughly mix all amendments in specified proportions prior to installation. Mix may be pre-blended or blended on site. Mix shall be approved by landscape architect prior to installation.

C. Soil and sand bases shall be completely pulverized and free of lumps or aggregated material. Moisture content of base materials shall not be such that chemical, granular or pelletized additives become dissolved during the mixing process.

D. Mix media in quantities of not less than 50 cubic yards or mix total quantity required, if less than 100 cubic yards. The Contractor shall be responsible for continuity between batches.

E. For soil media mixes, do not incorporate soil from mixing area with mix.

END OF SECTION 32 91 14

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1 Work covered in this section shall include all materials, labor, equipment and supervision required for the installation of turf grass where and as described on the Drawings and in the Specifications. This work includes, but is not limited to the following:

A. Establishment of turf by sodding.

.

B. Installation of turf by the hydroseed method.

C. Site cleans up.

D. Maintenance and guarantee.

1.2 RELATED SECTIONS

A. Fine Grading: Section 31 22 16

B. Plants: Section 32 93 00

1.3 QUALITY ASSURANCE

A. Sod: Shall be subject to inspection and approval by landscape architect, owner or owner's representative at the site upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. The owner or owner's representative reserve the right to refuse inspection at this time is in his judgment; a sufficient quantity of sod is not available for inspection.

B. Seed: Owner or owner's representative shall be furnished a signed copy of statement from vendor, certifying that each container or bag of seed delivered is labeled in accordance with the Federal Seed Act and is at least equal to requirement previously specified. Seed analysis shall be furnished prior to commencement of planting operations. Each lot of seed may be re-sampled and retested in accordance with latest rules and regulations under the Federal Seed Act at the discretion of the owner or owner's representative. If these tests reveal the seed to be below the specified pure live seed content, the contractor shall be required to plant additional seed to compensate for the deficiency at no cost to the owner.

C. The owner or owner's representative reserves the right to take or request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at contractor's expense. Cost of replacement of materials not meeting specifications shall be paid by the contractor.

1.4 INSPECTIONS

A. Make written request for inspection after seeding of sodding operation have been completed. Such inspection is for the purpose of establishing maintenance period.

B. Submit written requests for inspection to the landscape architect, owner or owner's representative at least 7 days prior to anticipate inspection date.

1.5 SUBMITTALS

A. Furnish required copies of manufacturers' literature, certifications, or laboratory analytical data for the following items:

1. Sod and seed source (certification).
2. Fiber mulch (laboratory analytical data)
3. Tank mix fertilizer (certification or laboratory analytical data)
4. Top dress fertilizer (certification)

PART 2 - MATERIALS

2.1 SEED

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers, unless exception is granted in writing by the owner representative. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

B. The minimum percentage by weight of pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

Kind of Seed	Minimum % Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
Summer Mix		
Common Bermuda Grass (Hulled)	85	65
Apply between September-November and/or March-May		
Winter Mix		
Common Bermuda Grass (Un-Hulled)	85	65
Winter Rye	90	200
Apply between October-December only.		

Note: % Pure Live Seed = % Purity X % Germination = 100

2.2 Weed seed shall not exceed ten percent (10%) by weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weak seed will not be allowed.

2.3 FERTILIZER FOR TANK MIX

A. The additives shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warranty of the producer. Fertilizer to conform to following for 1,000 sf

20 lbs. (3-13-13) NPK for Turf

2.4 WOOD CELLULOSE FIBER MULCH

A. Wood cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed

in such a manner that it will not contain germination or growth-inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to 18% moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 lbs. and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.

2.5 WATER

A. Shall be free from oil, acid, alkali, salt, and other substances harmful to growth of grass. The water source shall be subject to approval prior to use.

2.6 SLURRY MIX COMPONENTS PER ACRE

Wood Cellulose Fiber Mulch 2,000
Pounds of Grass Seed . . . . . .(as specified)
Fertilizer (13-13-13). . . . . 800 pounds

2.7 TOP DRESS AND LAWN FERTILIZER FOR EXISTING LAWN (DELAYED APPLICATION)

A. Complete fertilizer, fifty percent (50%) of the nitrogen to be derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bone, or tankage. Potash shall be derived from muriatic of potash containing sixty percent (60%) potash with elemental 20% iron sulfate equivalent to 400 lbs/acre:

16% Nitrogen
6% Phosphoric Acid
8% Potash

2.8 SOD

A. Sod shall be one (1) year old “419 Bermuda grass” (Cynodon dactylon). Sod shall be dense with grass having been mowed at one and one-inch (1") height before lifting from field. All sod delivered to the site for the duration of the project shall be uniformly cut by the same sod cutter or multiple machines adjusted to cut the same thickness of sod root/soil mass.

B. Sod shall be in vigorous condition, dark green in color, free of disease and harmful insects and grown on fumigated soil.

C. Do not stack for more than 24 hours between time of cutting and time of delivery.

D. The landscape architect reserves the right to reject any sod deemed unacceptable for installation.

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

A. Prior to spreading topsoil for fine grading, contractor is required to remove any weeds that may had grown during the construction period by applying herbicide such as “Round Up” or approved equal.

    1. Till all areas to receive seeds prior to spraying herbicide. After applying the first round of herbicide, wait two weeks and reapply second round. Wait another week then bring top soil for fine grading.

B. Bed Preparation: Spread topsoil to a 2”-3” minimum depth required and feather smoothly into finished grade at edge so as to blend with adjacent ground shapes. Immediately after finished grade has been approved, begin hydroseeding operation to reduce excessive weed growth.

C. The contractor shall apply seed, fertilizer and mulch by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified above.

D. Spraying Equipment: The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

    1. The spraying unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds per square inch. The pump shall be mounted in a line which will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipelines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

E. Homogeneously mix slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water.

    1. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. Nozzles or spray shall never be directed toward the ground in such a manner as might produce erosion or runoff. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The landscape architect may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

F. Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate and to guard against miss and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area. Check on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets or paper or pans over the area at intervals and observing the quantity of material deposited thereon.

G. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.

H. Keep hydromulch within areas designated and keep from contact with other plant material.

I. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.

J. After application, the Contractor shall not operate any equipment over the covered area.

K. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean maintenance operations.

L. The contractor shall guarantee a good healthy stand of grass. Areas that fail to germinate within a reasonable period of time (3 to 4 weeks) shall be reseeded until healthy stands of grass are attained.

3.2 TOP DRESS FERTILIZER

A. Apply top dress fertilizer at the rate of six (6) pounds per 1,000 square feet at 21 days after seeding or sodding.

3.3 SODDING ON PREPARED FINISHED GRADE:

A. Do not commence sodding operation until irrigation system and fine grading are completed and verified by the landscape architect, owner or owner's representative.

B. Bed Preparation:

1. Remove any weed or other volunteer plant growth from lawn areas by tilling all areas to receive sod prior to spraying herbicide. After applying the first round of herbicide, wait two weeks and reapply second round. Wait another week then bring in top soil for fine grading.

2. Fine grade all lawn areas with a minimum application of 2"-3" top soil. Spread topsoil by hand raking, breaking up lumps and providing a smooth even friable bed. Fine grade topsoil so finish grade is 1" below adjacent tops of edging, curbs and walks. Limit fine grading to areas which can be planted immediately after grading. Where proposed sod meets existing lawn, cut grade at limit so top of new sod is even with existing grade.

3. Immediately after the finished grade has been approved, begin sodding operations to reduce excessive week growth. If soil is dry immediately prior to sod installation, dampen surface with a fine mist of water.

C. Installation:

1. Lay sod so that adjacent strips butt tightly with no spaces between strips. Sod joints shall butt evenly with no overlap. Discard sod with irregular edges, discolored, uneven thickness or insufficient topsoil. Lay sod on mounds and slopes with strips parallel to contours. Stagger joints. Sodded areas shall be flush with adjoining seeded areas.

2. Peg sod on slopes three to one or steeper with pegs driven through sod into soil until pegs are plush with turf. Space pegs 18 inches on center. Pegs to be one-inch (1") square by six inches (6") long pine or six-inch (6") lengths of lath or similar approved device.

3. Roll sod to eliminate any undulation or unevenness of finished grade.

4. Sod joint shall be top dressed with sharp sand. Reroll again to achieve an even

uniform lawn.

5. Water sod thoroughly within 45 minutes of lying with water truck, firehouse or similar method to deliver quick application of water.

6. Trim all sod edges and planting bed edges by the end of the same day as adjacent sod is laid. Hand water trim pieces as above.

7. Immediately after installation of the sod, remove sod clumps and soil. Keep all areas clean during the maintenance period.

8. Sod shall not be laid on saturated wet or muddy ground, as it will creates deep undulation.

3.4 REPAIR OF EXISTING TURF

A. All areas within this contract not disturbed by construction or where repair of grade is not required shall be over seeded with a cyclone or equivalent type machine at one half the rate of the specified hydroseed mix.

B. Apply full rate of post seeding fertilizer as specified above.

3.5 MAINTENANCE BY THE CONTRACTOR

A. Maintenance under this contract shall commence immediately and include the care and periodical mowing as required to keep the site clean and presentable.

B. The contractor's maintenance period shall begin upon issuance of the Notice to Proceed and shall not be complete until final acceptance by the landscape architect, owner or owner’s representative.

C. The contractor's maintenance of new turf planting shall consist of watering, weeding, re- pair of all erosion and resodding as necessary to establish a uniform stand of specified grasses. Contractor shall guarantee growth and coverage of planting under this contract to the effect that all turf areas will be covered with specified planting after sixty (60) days with no bare spots greater than four (4) square feet. Any sod panels that are dead or dying shall be replaced.

D. Mowing shall be performed by the contractor during construction and per the agreed maintenance period after substantial completion. It shall be the owner’s responsibility after the agreed maintenance period.

E. The contractor shall not be held responsible for failures due to neglect by the owner, vandalism, or the act of god, during the guarantee period. Report such conditions to the landscape architect, owner or owner’s representative in writing.

3.6 FINAL ACCEPTANCE (END OF MAINTENANCE PERIOD)

A. Work under this section will be accepted by landscape architect upon satisfactory completion of all work, but exclusive of re-application under the guarantee period. Final Acceptance of lawn establishment shall be as follows:

B. Sod shall healthy, full and sod joints shall show minimal visibility.

C. Full coverage of all areas hydroseeded with full even coat of hydroseed mulch. Thin areas shall be reapplied.

D. Schedule overseeding operations with landscape architect, owner or owner’s representative

for observation of method and confirmation of application and conformity to rates specified.

3.7 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during lawn installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to final acceptance to the satisfaction of landscape architect, owner or owner's representative

END OF SECTION 32 92 00

SECTION 32 92 13 - HYDROMULCH SEEDING

PART 1 - GENERAL

1.1 SCOPE

A. Refer to the Drawings, Schedules and Details for type and locations of work required herein. Furnish all labor, materials, equipment and supervision for the installation of items included within these specifications. Such work includes, but is not limited to the following:

1. Furnishing and applying hydromulch seeding including all materials and equipment required for the specified method of lawn installation.

2. Site cleanup.

3. Maintenance and guarantee.

1.2 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references thereto:

1. Texas Department of Transportation 2004 Standard Specifications for construction of Highways, Street and Bridges (TxDOT).

   a. Item 162 - Sodding for Erosion Control

   b. Item 164 - Seeding for Erosion Control

1.3 RELATED WORK

A. Section 31 22 13 - Site Grading.

B. Section 31 25 13 - Erosion and Sedimentation Control

C. Section 32 92 00 Turf and Grasses

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform Work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

1.5 SUBMITTALS

A. Samples:

1. The Owner reserves the right to request samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at Contractor's expense. Cost of replacement of materials not meeting the specifications shall be paid by Contractor.

2. Typical requests from the owner may include copies of manufacturers' literature, certifications, or laboratory analytical data for the following items:

a. Fibre Mulch.

b. Tank Mix Fertilizer.

c. Top Dress Fertilizer.

1.6 SCHEDULE

A. Submit a proposed work schedule to the Owner for approval at least fifteen (15) days prior to start of work under this Section. After approval, no modification shall be made to this schedule without written authorization by the Owner.

B. In general, the work shall proceed as rapidly as the site becomes available, consistent with normal seasonal limitations for planting work.

1.7 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Furnish standard products in manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. Submit written requests for inspections to the Landscape Architect at least seven (7) days prior to anticipated inspection date.

PART 2 - MATERIALS

2.1 SEED

A. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of Invitation for Bids. All seed shall be furnished in sealed standard containers unless exception is granted in writing by the Landscape Architect. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. The minimum percentage by weight or pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

Kind of Seed	Minimum % Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
Bermuda Grass	85	7
K.R. Bluestem	85	1
Bahiagrass (Pensacola)	85	9

Note: % Pure Live Seed = (% Purity) X (% Germination)

B. Weed seed shall not exceed ten (10%) of weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weed seed will not be allowed.

C. Source - Quality Control

1. Seed: The Contractor must follow the Federal Seed Act with respect to interstate commerce and transportation. Each lot of seed may be re-sampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Owner. The seed retests will be conducted by a testing laboratory allowed by the State of Texas Department of Agriculture Seed Control Office. Material found to be below specified content levels will be at the contractor’s responsibility to correct by removing and replanting and/or additional plantings.

2.2 FERTILIZER FOR TANK MIX

A. Shall be 13-13-13 grade, pelleted, uniform on composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warrant of the producer.

2.3 WOOD CELLULOSE FIBER MULCH

A. Wood Cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will not contain germination of growth inhibiting factors. It shall be dyed a green color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that meets all of the foregoing requirements.

2.4 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

1. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

2.5 SLURRY MIX COMPONENTS PER ACRE

A. Wood Cellulose Fiber Mulch = 2,000 pounds

B. Grass Seed = (as specified)

C. Fertilizer (13-13-13) = 800 pounds

2.6 TOP DRESS FERTILIZER

A. (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to the derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:

1. 16% Nitrogen
2. 6% Phosphoric Acid
3. 8% Potash

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

A. Bed Preparation: Immediately after the finished grade has been approved, begin hydroseeding operation to reduce excessive weed growth.

B. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient of agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus a combined total of seventy (70) pounds of fertilizer solids for each one hundred (100) gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Landscape Architect may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

C. Mixing: Care shall be taken that the slurry preparation should be accomplished per the material supplier's recommendations and the equipment manufacturer's written operations manual. Spraying shall commence immediately when the slurry is mixed and the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

D. Application:

1. Contractor shall obtain approval of hydromulch area preparation from the Landscape Architect prior to application.

2. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.

3. Keep hydromulch within areas designated and keep from contact with other plant material.

4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.

5. After application, the Contractor shall not operate any equipment over the covered area.

6. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.

7. Refer also to the maintenance portion of this section.

8. All areas designed on drawings shall be covered uniformly with specified materials using hydromulching processes. If surfaces remain uncovered within the designated area, the Contractor shall seed with required grasses or ground cover materials those areas missed by the hydromulch application. Method used to seed these missed surfaces shall be an alternate seeding operation approved by the Landscape Architect/Owner's Representative and shall be accomplished at no additional cost to the Owner.

3.2 CLEAN UP

A. Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during installation operations. Clean up and removal all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Landscape Architect.

3.3 INSPECTIONS

A. Make written request for inspection prior to seeding and after areas have been seeded.

B. Submit requests for inspections to Landscape Architect at least two (2) days prior to the anticipated inspection date.

3.4 MAINTENANCE BY THE CONTRACTOR

A. The Contractor shall begin maintenance after each plant is installed and continue until Final Acceptance.

B. The Contractor's maintenance of new planting shall consist of watering, weeding, repair of all erosion and reseeding and re-sodding as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of hydromulch planting under this Contract to the effect that a minimum of ninety-five (95%) percent of the area planted will be covered with specified planting after sixty (60) days with no bare spots greater than ten (10) square feet. Any sod panels that are dead or dying shall be replaced.

C. The Contractor shall be responsible for one (1) mowing in the event that the time between seeding or sodding and Final Acceptance exceeds thirty (30) days.

D. Contractor shall make a second application of specified hydromulch planting to bare areas not meeting specified coverage as determined by the Landscape Architect. Such replanting to be performed within sixty (60) days of initial application and immediately upon notification by Landscape Architect to replant.

E. Apply top dress fertilizer (16-6-8) at the rate of ten (10) pounds per 1,000 square feet at no less than nor more than twenty-five (25) days after seeding unless approved in writing by the Owner.

3.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work, but exclusive of re- application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:

B. For Seed: Ninety-Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.

C. The Landscape Architect and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

END OF SECTION 32 92 13

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes specifications for furnishing and installing planting materials including:

1. Organic and chemical fertilizer

2. Mulch

3. Planting media and accessories

1.2 RELATED SECTIONS

A. Planting Irrigation: Section 32 84 00

B. Planting Media: Section 32 91 14

C. Turf and Grasses: Section 32 92 00

1.3 STANDARDS

A. American National Standards Institute (ANSI)/American Association of Nurserymen (AAN): ANSI Z60.1 1-069 "Nursery Stock".

B. "Grades and Standards", latest edition of Texas Association of Nurserymen Specifications, Austin, Texas 78704.

C. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by federal, state, and local authorities in furnishing, transporting, and installing materials.

1.4 QUALITY ASSURANCE

A. Installer: Installation of planting work shall be performed by a single firm specializing in landscape and planting work. Contractor shall be licensed by the Texas Association of Nurserymen, shall possess an agricultural certificate, shall be a licensed pest applicator, and shall have not less than 5 years of experience in this type of work.

B. Installer's field supervision: Require Installer to maintain an experienced full-time supervisor on project site when work is in progress.

1. Pesticide Applicator: State licensed for commercial work is required.

C. Compliance: Ship planting materials with Certificates of Inspection as required by governing authorities. Comply with all applicable local, state, and federal requirement regarding materials, methods of work, and disposal of excess and waste materials.

D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions or disfigurement.

E. Analysis and Standards: All packaged products shall be delivered in original

manufacturer's sealed containers. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

1.5 MATERIAL INSPECTIONS

A. Plants shall be subject to inspection and approval by landscape architect upon delivery for conformity to specifications. Landscape architect may reject plant material that in his opinion does not conform to specifications. Submit a written or verbal request for inspection of plant material to landscape architect at least five (5) days prior to preferred date. The landscape architect reserves the right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection. The contractor shall submit alternate source for material if primary source of material deem unsatisfactory to meet specifications.

B. Substitutions of plant materials will not be permitted unless authorized in writing by landscape architect. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of contract price. Such proof shall be substantiated and submitted in writing to landscape architect at least thirty (30) days prior to start of work under this Section. These provisions shall not relieve contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

C. Contact landscape architect for inspection after planting operation has been completed. Such inspection is for the purpose of establishing the maintenance period.

D. Request for inspections to the landscape architect 5 working days prior to anticipate inspection date.

1.6 SUBMITTALS

A. Furnish required copies of photos of plant materials from their sources, manufacturers literature, samples, certifications, or laboratory analytical data for the following items:

1. Tree, shrubs and groundcovers (Samples and / or photographs)

2. Planting backfill mix (sample bag)

3. Mulch (manufacturer’s literature and samples)

4. Tree and shrub planting fertilizer (certification or laboratory analytical data)

5. Tree paint (manufacturer’s, literature)

6. Subdrainage materials (pipes, gravel, soil separator) *if applicable*

7. Geotextile Fabric *if applicable.*

1.7 PLANT MATERIAL DELIVERY, STORAGE AND HANDLING

A. The following considerations for product handling shall be evaluated:

1. During hot weather and when practical, the contractor may be required to transport plant materials between sunset and sunrise if transported in an open trailer or unrefrigerated van.

2. Dug material should be maintained and watered as required at the nursery to guarantee their vitality and health until shipping.

3. Protect from all damage trunks, stems, branches and root balls during tree tying, wrapping and loading operations.

4. Load containers onto transport vehicle and secure in a manner that protects the structural integrity of the root balls and branches.

5. The contractor shall be solely responsible for the safe transportation of plants to the site and their condition upon arrival. Trees damaged, dehydrated or abused during transit and storage will be rejected.

6. Plant materials should not be stored on concrete or left exposed to examples of climate without adequate protection.

7. Protect the root balls and water regularly until planting. If trees are left in storage over the weekend or holiday provide a means of periodical watering and inspection of container moisture.

8. B & B material shall be stored and maintained in a manner which affords protection from dehydration and damage of root ball. Root balls shall be wrapped and stored in mulch or approved containers.

B. The landscape architect may inspect any phase of this operation and may reject any plant material improperly handled during any point of this operation.

C. Nothing in this section shall be interpreted as relieving the contractor of his responsibility to provide healthy, viable plants, nor shall it have any affect upon the terms of the warranty specified herein.

1.8 INCIDENTAL REPAIRS

A. The landscape contractor shall coordinate repairs of damage to irrigation system incidental to the planting operation by either own forces or by irrigation subcontractor. Above repairs shall be made immediately so as to not interfere with the automatic cycling of the irrigation system. All repairs shall be permanent and include all flushing required to clean the lines of debris deposited by such damage.

B. Incidental damage to work by other subcontractors during landscape installation shall be made immediately and at no extra cost to the owner.

1.9 JOB CONDITIONS

A. Work Scheduling: Proceed with and complete planting work in a timely manner, working within seasonal limitations for each kind of planting work required.

B. Planting Time

1. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

2. Plant trees, shrubs and groundcover after final grades are established and prior to planting of lawns, unless otherwise directed by landscape architect or owner's representative in writing. If planting occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

C. Utilities: Refer to drawings and coordinate with utility contractor for location of utilities. Contractor shall be responsible for damage to existing utilities and structures.

D. Security: The owner will not assume any responsibility for security of any materials, equipment, etc. during construction of the project until project acceptance.

E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions beyond the scope of this contract, or obstructions, notify owner's representative of such conditions, immediately and before planting.

F. Pollution Control: Control dust caused by planting operations. Dampen surfaces as necessary. Comply with pollution control regulations of governing authorities.

PART 2 - MATERIALS

2.1 PLANTS

A. Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least 12 (twelve) months unless specifically otherwise authorized by landscape architect in writing. Unless specifically noted otherwise, all plants shall be heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.

B. Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

C. Plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if approved by landscape architect. Use of such plants shall not increase contract price. If larger plants are approved, the ball of earth or container size shall be increased as specified under “Applicable Standards” and subject to the approval of the landscape architect.

D. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Caliper measurement shall be taken at a point on the trunk six inches (6") above natural ground four inches (4") in caliper and at a point twelve inches (12") above the natural ground line for trees over four inches (4") in caliper. If a range of size is given, no plant shall be less than the minimum size and not less than 40% of the plants shall be as large as the maximum size specified. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

E. Container stock shall have grown in the containers in which delivered for at least six months, but not over two years. Samples must prove no root bound conditions exists. No container plants that have cracked or broken balls or earth when taken from container shall be planned. Container stock shall not be pruned before delivery. Field grown plants recently transplanted into containers will not be accepted.

F. Balled and burlap trees, when accepted, shall have a root ball size of ten (10X) times the caliper minimum.

1. Nursery grown B&B material shall be first pruned and thinned at the place of growth immediately prior to digging as required for packaging and safe moving. Method or pruning shall be as approved in the field by the landscape architect. Do not remove self-locking tags during this pruning prior to delivery to site. Final pruning shall take place at the site.

G. Trees which have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Trees with abrasions of the bark, sun scalds, disfiguring knots, or fresh cuts of limbs over 3/4 "which have not completely callused, will be rejected.

H. Method of pruning shall be as approved in the field by the landscape architect. Do not remove self-locking tags during this pruning prior to delivery to site. Final pruning shall take place at the site.

I. Plant Materials

1. Refer to landscape plans and plant schedule.

2.2 GUYING MATERIALS

A. The contractor shall use guying materials necessary to meet the requirements herein.

1. Pressure-treated 2" diameter lodge poles, "Wolman" treated, as provided by Bourbow Valley Company or approved equal. Contractor may use T-post only if prior approved by landscape architect.

2. Ties: Flexible strapping / Black rubber tire or another tie, as approved.

3. Tree Guying Material: Galvanized aircraft cable (7 x 19 GAC).

4. 12D Galvanized nails. *(if applicable)*

5. Hardware

a.	Guying cables:	7 x 19 aircord, size as specified.
b.	Turnbuckles:	galvanized or dip-painted, size as specified.
c.	2 holes crimping clamps:	galvanized or copper, size as required.
d.	Plastic guy covers:	3/8 "diameter x 3 'long white plastic tubing.

2.3 WATER

A. Furnished by owner. Transport as required.

2.4 PRE-EMERGENCE WEED CONTROL

A. All landscape and grass areas shall be treated with organic pre-emergent herbicide whenever possible. Application rate and timing shall be based on manufacturer’s recommendation.

B. If applying organic pre-emergent herbicide is not feasible, commercial chemical herbicide may be used with prior approval from landscape architect or owner’s representative. Application rate and timing shall be based on manufacturer’s recommendation. Treatment should be only applied by state licensed commercial applicator.

C. If necessary, contact herbicide may be use such as Roundup or approved equal. Do not exceed manufacturer's recommended rate of application. Treatment should be only applied by state licensed commercial applicator.

2.5 MULCH

A. Mulch for top dressing: Shall be organic mulch free from deleterious materials, debris and suitable for top dressing of trees, shrubs or ground covers. Mulch shall be the product of standard stripping of bark from pine, oak, or hardwood for fiber or pulp manufacturing with dark brown in color. Bark shall be shredded in a manner where large pieces are at a minimum.

B. Compost Mulch: Enriched bark mulch for bed prep shall be as above with additional organic of peat and/or manure.

2.6 PIPE FOR WATERING TUBE

A. Shall be perforated Polyvinyl Chloride pipe, Type (SDR 35), gray in color.

2.7 PLANTING MIX

A. See Planting Media: Section 32 91 14

2.8 FERTILIZER

A. Post planting fertilization shall be 100% organic.

1. Microlife or approved equal and apply at manufacturer's recommendation rate.

2.9 WEED BARRIER / GEOTEXTILE FABRIC

A. Typar #3401 terminally spunbonded polypropylene, non-woven, weed control fabric, 4.0 oz / lineal yard weight by American Excelsior or approved equal.

B. Contractor is required to submit samples and product data for approval prior to installation.

PART 3 - EXECUTION

3.1 LAYOUT AND EXCAVATION OF PLANTING AREAS

A. Layout plants in locations shown on drawings. Use wire stakes color-coded for each species of plant material or spray paint with nontoxic paint to delineate each plant species and outline bed locations. Each tree shall be staked for approval prior to planting.

B. The landscape architect will check location of plants in the field and shall adjust to exact position before planting begins.

C. If underground obstructions are encountered notify the landscape architect as to whether an adjustment or change of location is possible within the design intent. If the contractor is allowed to adjust or change location, rather than remove the obstruction, he shall make the change at no expense to the owner. Backfill and tamp abandoned pits have obstructions which cannot be removed.

3.2 EXCAVATION TO SUBGRADE FOR PLANTING AREA AND VERIFICATION OF FINISHED GRADE

A. Excavate all planting areas (pit and beds) to required depth as hereinafter specified and stockpile enough material to prepare planting mix for all plants. Remove excess material from site.

B. Verify that required grades are within two (2”) inches of required subgrade provided under a separate contract and excavate further as may be required.

C. Subsoil shall not be worked when moisture content is so great that excessive compaction will not occur, nor when it is so dry that clods will not break readily. Water shall be applied, if necessary, to bring soil to an optimum moisture content before tilling and planting.

D. Do not excavate tree pits more than 24 hours in advance of planting operation. Excavate container grown tree pits to the following dimensions:

Excavation for	Width	Depth
Boxed trees	Box + 24 in.	Ball + 6 in.
Container grown trees	Cont. + 18 in.	Ball + 6 in.
B&B trees	Ball + 12 in.	Ball + 6 in.
Container grown shrubs	Cont. + 12 in.	Ball + 4 in

1. Excavation for trees pits in areas of select fill (crushed and compacted limestone or similar) shall be twice as wide and twice as deep as given root ball. Fill bottom four inches of tree pit with gravel and cover with soil separator before backfilling pit.

E. Excavate shrub and ground cover beds to the following depths:

Excavation for	Width	Depth
Shrubs &	Entire Bed	Cont. + 4 in., not to be less than
Groundcover	Entire Bed	Cont. + 4 in., not less than 8 in

F. Rip or cultivates subgrade in pits and beds to a depth of three (3”) inches minimum.

3.3 DRAINAGE, DETRIMENTAL SOILS AND OBSTRUCTIONS

A. Test drainage of plant beds and pits by filling with water twice in succession. Conditions permitting the retention of water in planting beds for more than twenty-four (24) hours or percolation of less than one (1") inch per hour shall be brought to the attention of the Landscape Architect.

B. Notify the landscape architect of all soil or drainage conditions contractor considers detrimental to growth of plant material. (State condition and submit proposal and cost estimate for correcting condition.)

C. If rock, hardpan, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits and beds, alternate locations may be selected by landscape architect. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than six (6") inches below the required pit or bed depth. Proceed with work after approval.

3.4 PREPARING PLANT MATERIALS FOR PLANTING

A. Container grown stock shall be removed carefully and handled only by the root ball. Do not lift or handle container plants by tops, stems, or trunks at any time.

B. Do not bind or handle any plant with wire or rope at any time so as to damage bark or break branches. Lift and handle plants only from bottom of ball.

C. Balled and burlap (B&B) plants shall have firm balls of earth. Plants moved with a ball will not be accepted if the ball is cracked or broken before or during planting operations. B&B material shall be dug only when dormant. Pre-dug stored B&B material shall be inspected and approved at the storage site.

3.5 INSTALLATION OF PIT PLANTED MATERIALS

A. Do not commence any planting until the irrigation system is completely automated or can be operated manually.

B. Fill plant pits with soil mix to compact depth to receive plant root ball, so top of root ball is two (2") inches above finished grade.

C. Install PVC watering tubes in tree pits, vertically, at edge of pit as shown.

D. Scarify the walls and bottom of all plant pits immediately prior to the placement of plant and backfill mix. The Contractor shall remove all glazing caused by an auger or mechanical hole digger.

E. For boxed & container grown material, break vertical bands and remove top and bottom of container. Carefully lower plant into pit with backhoe or approved method and adjust elevation. Cut horizontal banks and remove sides. Prune away girdled roots and tease root hair masses. Carefully fill pit and compact by watering in to support root ball.

F. Place B&B plants carefully in the prepared planting pit. Do not disturb root ball or untie twine or roping until backfill settlement is complete, and tree is staked, if applicable. Fill planting pit by flooding each eight (8") inches of backfill for balls greater than 24" diameter. Wrap trunks with double layer of tree wrap.

G. Smooth planted areas to conform to specified grades after full settlement has occurred. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage, shall be brought to the attention of the landscape architect in writing.

H. Mulch circles shall not exceed width of root mass by more than 4". Mulch circles shall meet lawn or bed grades evenly and smoothly.

I. Water all plants immediately again after planting.

J. Apply pre-emergent weed control material in areas to receive mulch.

K. Spread mulch in required areas to the compacted depth of two (3") inches.

3.6 INSTALLATION OF BED PLANTED MATERIALS

A. Install steel edging where shown. Anchor with steel stakes spaced not more than three (3’) feet O.C. or as per often as necessary to have smooth radius or straight tangent. Drive stake to one (1”) inch below top of edging.

B. Fill all shrub and groundcover beds with plant bed mix to finished grade (compacted) plus two (2”) inches minimum.

C. Excavate in planting mix for individual plant and install as required. Set plant plumb and brace rigidly in position until planting soil mix has been tamped solidly around the ball and roots.

D. When plant pits have been backfilled approximately two-thirds (2/3) full, fertilizer per manufacturer’’ recommendations at the maximum rate.

E. Water plant thoroughly, saturating root ball, before installing remainder of the planting soil to top of pit, eliminating all air pockets. Top of root ball shall be two (2”) inches above finished grade.

F. Smooth planting areas to conform to specified grade after full settlement has occurred. Contractor shall bear final responsibility for proper surface drainage of planting areas.

F. Water all plants immediately again after planting.

G. Apply pre-emergent weed control material over entire area to receive mulch.

H. Mulch all shrub and groundcover beds to three (3") thick.

3.7 SURFACE DRAINAGE OF PLANTING AREAS

A. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage, shall be brought to the attention of the landscape architect in writing.

3.8 POST PLANTING FERTILIZATION

A. Tree Planting

1. Apply fertilizer 30 - 45 days after installation.

2. Inject material specified in Section 2 with a high pressure injector into soil at depth and diameter shown below.

Tree Caliper	Application Points	Radius	Depth	Application Rate Per Tree
Under 2"	3	4" - 6"	16" - 18"	1-1/2
2" - 4"	3	4" - 6"	18" - 24"	2
4" - 5"	4	4" - 6"	2' - 3'	2-1/2
5" - 6"	5	4" - 6"	3' - 4'	3
Above 6"	3' 0. C.	4" - 6"		5 gal./100 sf Root Area (Drip Line)

3.9 PRUNING

A. Prune containerized plants only at time of planting and according to standard horticultural practice to preserve the natural character of the plant. Prune by removing entangled branching and by removing crotches. Avoid removing branch tips wherever possible. Pruning shall be done under supervision of the landscape architect.

B. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools.

C. Prune lower branching from trees to a height of 18" above ground per 1 1/4" caliper.

D. Prune B&B material in addition to place of growth as may be directed by landscape architect by removing a percentage of interior branching proportional to the root loss during digging (up to 1/3).

3.10 STAKING

A. The Contractor will be responsible for material remaining plumb and straight for all given conditions through the guarantee period. Tree support shall be done as outlined on the following tables and as illustrated on the details.

B. Trees should be staked during the same day as planting. Plants shall stand plumb after staking.

C. Stake all trees under 3 inches caliper in accordance with the following table:

Tree Caliper	Stakes	Length	Stake Size
To 1-3/4 in.	2	8'	Lodge/pole (2" dia)
2 in. to 3 in.	2	8'	Lodge/pole (2" dia)

3.11 MAINTENANCE BY THE CONTRACTOR

A. The contractor shall begin maintenance after each plant is installed and continue until final acceptance.

B. The contractor's maintenance period shall begin upon inspection and approval at Substantial Completion and shall be for 90 days or to be determined by owner.

C. The contractor's maintenance of new planting shall consist of watering, cultivating, weeding, mulching, re-staking, tightening and repair of guys, resetting plants to proper grades or upright position, and furnishing and applying such pesticide sprays and invigorates as are necessary to keep the plantings free of insects and disease and in thriving condition.

D. Protect planting areas and plants at all times against damage of all kinds for duration of maintenance period. Maintenance includes temporary protection barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by landscape architect at no additional cost to the owner.

3.12 FINAL ACCEPTANCE

A. Work under this section will be accepted by landscape architect upon satisfactory completion of all work, including maintenance, but exclusive of replacement of plant materials under the warranty period. Upon termination of maintenance period, the owner will assume responsibility for maintenance of the work.

3.13 WARRANTY

A. Planting shall be warranted by the contractor to remain alive and healthy for a period of 12 months after the date of Substantial Completion. Plants in an impaired, dead or dying condition after initial acceptance or within 12 months shall be removed and replaced. New planting and method of placing shall comply with the requirements of the specifications. Plants replacing those removed during the guarantee period shall also be guaranteed to remain alive and healthy for an additional 12 months after installation and acceptance.

B. Contractor shall not be held responsible for failure due to neglect by owner or property manager, vandalism, acts of god, during warranty Period. Report such conditions to the landscape architect or owner’s representative in writing when discovered.

C. Contractor shall indicate during Pre-Bid regarding warranty status of plant material in the case of no irrigation system provided in the project.

D. Submit a letter of warranty containing the following information:

E. We hereby guarantee that landscape planting we have furnished and installed is free from disease and in good condition, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted.

F. We agree to repair or replace any defects, at no additional cost to the owner. We shall make such repairs or replacements within a reasonable time, as determined by the owner, after receipt of written notice.

G. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the owner by certified mail, we authorize the owner to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore, upon demand.

3.14 CLEAN UP

A. Clean up all areas as required for complete and acceptable inspection.

B. It is Contractor’s responsibilities to replace or restore any damaged or disturbed areas during planting operation back to its original condition.

3.15 INSPECTIONS

A. Submit requests for inspections to the landscape architect at least five (5) days prior to anticipated inspection date.

END OF SECTION 32 93 00

SECTION 33 05 13.00 – MANHOLES AND STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASME B 16.1 -Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 -Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

C. ASTM A 615 -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM C 270-Standard Specification for Mortar for Unit Masonry

E. ASTM C 443 -Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

F. ASTM C 478 -Standard Specification for Precast Reinforced Concrete Manhole Sections

G. ASTM C 923 -Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

H. ASTM C 1107 -Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

I. ASTM D 698 -Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/fr')

J. ASTM D 2665 -Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

K. ASTM D 2996 -Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

L. ASTM D 2997 -Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

M. AWWA C 213 -Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

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

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's data and details of following items for approval:
   1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.
   2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.
   3. Frames, grates, rings, and covers.
   4. Materials to be used in fabricating drop connections.
   5. Materials to be used for pipe connections at manhole walls.
   6. Materials to be used for stubs and stub plugs, if required.
   7. Materials and procedures for corrosion-resistant liner and coatings, if required.
   8. Plugs to be used for sanitary sewer hydrostatic testing.
   9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches.

C. Seal submittal drawings by Professional Engineer registered in State of Texas.

PART 2 P R O D U C T S

2.1 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide tops to support HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Owner’s Representative.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.
   1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs.
   2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
   3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.
   4. Intemalliquid pressure based on unit weight of 63 pcf.
   5. Dead load of manhole sections fully supported by transition and base slabs.

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:
   1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.
   2. Wall loading conditions:
      a. Saturated soil pressure acting on empty manhole.
      b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure.
   3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater.

G. Provide joints between sections with O-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

2.2 CONCRETE

A. Conform to requirements of Division 32.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4,500 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Division 31.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4,500 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.3 REINFORCING STEEL

A. Conform to requirements of Division 32.

2.4 MORTAR

A. Conform to requirements of City of Houston Standard Specifications Section 04061 – Mortar.

2.5 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Division 33.

2.6 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.7 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.
   1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:
      a. External clamps: Type 304 stainless steel.
      b. Internal, expandable clamps on standard manholes: Type 304 stainless steel,

11 gauge minimum.

c. Internal, expandable clamps on corrosion-resistant manholes:
   1) Type 316 stainless steel, 11 gauge minimum.
   2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213.

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:
1. Provide watertight connections in accordance with ASTM C 923.

C. Water Lines
1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.
2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.8 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.

B. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

C. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.9 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on Drawings, provide one of following:
1. PVC liner for precast cylindrical manhole section, base sections, and cone sections in accordance with Division 33.
2. Precast base sections, as specified above, lined with PVC or equal and fiberglass manholes in accordance with Division 33.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Division 31.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:
   1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.
   2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive.
   3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.
   4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by The Engineer from manufacturer's standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of manholes, including adjustment of manholes to grade unless approved by the Engineer. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings.
   1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
   2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.
   3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.
   4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by the Engineer.

3.2 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.3 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Division 2.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify the Engineer for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24 inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

3.4 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.

E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

3.5 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.
   1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See Drawings for placement of assembly in manhole sections.
   2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either

interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

E. Test connection for watertight seal before backfilling.

3.6 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
   1. Slope of invert bench: 1 inch per foot minimum; 1-1/ 2 inches per foot maximum.
   2. Depth of bench to invert:
      a. Pipes smaller than 15 inches: one-half of largest pipe diameter.
      b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter.
      c. Pipes larger than 24 inches: equal to largest pipe diameter.
   3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.7 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of four (4) inches outside bells.

B. Install drop connection when sewer line enters manhole higher than 30 inches above invert of manhole.

3.8 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.9 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 3 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Division 31. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Division 32. When shown on Drawings, sod disturbed areas in accordance with Division 32.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Division 33.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to the Owner.

END OF SECTION

SECTION 33 05 13.13 – MANHOLE GRADE ADJUSTMENT

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S

2.1 CONCRETE MATERIALS

A. Provide concrete, conforming to requirements of Division 33.

B. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Division 33.

C. Provide mortar conforming to requirements of City of Houston Standard Specifications Section 04016 - Mortar.

2.2 CAST-IRON MATERIALS

A. Provide cast-iron materials conforming to requirements of Division 33.

2.3 PIPING MATERIALS

A. For riser pipes and fittings, refer to Division 33.

2.4 MASONRY MATERIALS FOR STORM SEWER MANHOLES AND INLETS

A. Provide brick masonry units conforming to the requirements of Division 32.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Project Manager.

3.2 ESTABLISHING GRADE

A. Coordinate grade related items with existing grade and finished grade or paving, and relate to established bench mark or reference line.

3.3 ADJUSTING MANHOLES AND INLETS

A. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in Division 33.

B. Salvage and reuse cast-iron frame and cover or grate.

C. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.

D. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manger's approval.

3.4 ADJUSTING VALVE BOXES

A. Salvage and reuse valve box and surrounding concrete block as approved by Project Manager. No separate pay.

B. Remove and replace 6 inch ductile iron riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade.

C. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6 inches telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.

D. After valve box has been set, aligned, and adjusted so that top lid is level with final grade.

3.5 BACKFILL AND GRADING

A. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Division 31.

B. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.

C. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Division 32.

END OF SECTION

SECTION 33 05 16.13 – PRECAST CONCRETE UTILITY STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Precast concrete headwalls and wingwalls for storm sewers.

C. Precast junction box with lid or grate top.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.5 STORAGE AND SHIPMENT

A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4,500 psi.

B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:
   1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.
   2. Welding of reinforcing steel is not permitted unless noted on Drawings.

C. Mortar and Hydraulic Cement: Conform to requirements of Division 32.

D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Division 33.

2.2 SOURCE QUALITY CONTROL

A. Tolerances: Allowable casting tolerances for concrete units are plus or minus 1/4 inch from dimensions shown on Drawings. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:
   1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.
   2. Surface defects indicating honeycombed or open texture.
   3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.

D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.

E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Owner's Representative, repaired units conform to requirements of these specifications.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.2 INSTALLATION

A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.

B. Excavate in accordance with requirements of Division 31.

C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.

D. Provide adequate means to lift and place concrete units.

3.3 FINISHES

A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.

B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.

C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.

3.4 INLET WATERTIGHTNESS

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.5 CONNECTIONS

A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.6 BACKFILL

A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Division 31.

END OF SECTION

SECTION 33 05 16.16 - CONCRETE FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

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

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

BB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

CC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

DD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

EE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

FF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

GG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

HH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

II. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

JJ. CRSI MSP-1 - Manual of Standard Practice.

KK. CRSI - Placing Reinforcing Bars.

LL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

MM. NRMCA - Concrete Plant Standards.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed mix design and test data for each type and strength of concrete in Work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Owner's Representative.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.5 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 P R O D U C T S

2.1 CONCRETE MATERIALS

A. Cementitious Material:
1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Owner's Representative; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.
2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na2O + 0.658K20.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:
1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
2. Fine Aggregate: ASTM C 33.
3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:
1. Water Reducers: ASTM C 494, Type A.
2. Water Reducing Retarders: ASTM 494, Type D.
3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:
1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:
1. Fibrillated Polypropylene Fiber:
a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
b. Physical Properties:
1) Material: Polypropylene.
2) Length: 1/2 inch or graded.
3) Specific Gravity: 0.9l.
c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.
2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
b. Physical Properties:
1) Material: Steel.
2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1.
3) Specific Gravity: 7.8.
4) Tensile Strength: 40-400 ksi.
5) Young's Modulus: 29,000 ksi.
6) Minimum Average Tensile Strength: 50,000 psi.
7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking.

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.2 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.3 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.4 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.5 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Owner's Representative for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Owner's Representative.

D. Classification:

Class	Type	Minimum Compressive Strength (LBS/Sq.In.)		Maximum W/C Ratio	Air Content (Percent)	Consistency Range in Slump (Inches)
		7-Day	28-Day			
A	Structural	3200	4000	0.45	4 ± 1	2 to 4*
B	Pipe Block Fill, Thrust Block	---	1500	---	4 ± 1	5 to 7
*When ASTM C 494, Types F or Type G admixture is used to increase workability, this range may be 6 to 9.						

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.6 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:
1. Thickness: not less than 3/8 inch.
2. Acceptable Manufacturers:
a. Kirkhill Rubber Co., Brea, California.
b. Water Seals, Inc., Chicago, Illinois.
c. Progress Unlimited, Inc., New York, New York.
d. Greenstreak Plastic Products Co., St. Louis, Missouri.
e. Approved equal.

2.7 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.

B. Bentonite Waterstop:
1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch.
4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:
1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
2. Meets or exceeds requirements of Federal Specification SS-S-210A.
3. Supplied wrapped completely by 2 part protective paper.
4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.
5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.
6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved equal.

PART 3 E X E C U T I O N

3.1 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Owner’s Representative, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.2 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Owner’s Representative and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Owner’s Representative. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.3 .EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.4 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 through 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Owner's Representative before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Owner's Representative.

3.5 PLACING CONCRETE

A. Give sufficient advance notice to Owner's Representative (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Owner's Representative's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators

cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.6 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

C. Splicing PVC Waterstops:
1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer’s printed instructions.
2. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.
3. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24 inch long strips of waterstop material beyond joint. Upon inspection and approval by Owner’s Representative, install prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24 inch strips to straight-run portions of waterstop in forms.

D. Setting PVC Waterstops:
1. Correctly position waterstops during installation. Support and anchor waterstops during progress of work to ensure proper embedment in concrete and to prevent folding over of waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
2. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6 inches below top of wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Specifications.

F. Resilient Waterstop:
1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
2. When requested by Owner’s Representative, provide technical assistance by manufacturer's representative in field at no additional cost to City.
3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6 inches and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.
5. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6 inches from top in vertical wall joints.
6. Bentonite Waterstop:
    a. Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.
    b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1 1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
    c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
    d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.
    e. In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12 inch maximum spacing.
7. Adhesive Waterstop:
    a. With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.
    b. If surface is too rough to allow waterstop to form complete contact, grind to form adequately smooth surface.
    c. Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1 inch and cover back over with protective paper.
    d. Do not remove protective paper until just before final form work completion. Place concrete immediately. time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.7 CONSTRUCTION JOINTS

A. Definitions:
1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.
2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Owner’s Representative. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.
3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.8 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Owner's Representative.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:
1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.
2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.
1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Owner's Representative. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.
2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.9 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Owner's Representative.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Division 1.

B. Unless otherwise directed by Owner’s Representative, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.
   1. Take concrete samples in accordance with ASTM C 172.
   2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.
   3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.
   4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Owner’s Representative, at no additional cost to City.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Owner's Representative.

END OF SECTION

SECTION 33 06 10.14 - POLYVINYL CHLORIDE (PVC) PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 48 inches.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches through 48 Inches for Water.

P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.

R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.

S. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.

T. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

U. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Owner’s Representative for review. Cost of testing paid by Contractor.

PART 2 P R O D U C T S

2.1 MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.
   1. Pipe Material:
      a. DR 18: For restrained joints where shown on Drawings.
      b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.
   1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
   2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:
   1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
   2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
   3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

G. Do not use PVC in potentially or known contaminated areas.

H. Do not use PVC in areas exposed to direct sunlight.

2.2 WATER SERVICE PIPE

A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 14 inch through 20 inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Owner's Representative.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

2.3 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

Wall Construction	Manufacturer	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
Solid	J-M Pipe Certain Teed Diamond Uponor ETI North American	D3034	SDR 26 / PS 115	6” to 10”
		D3034	SDR 35 / PS 46	12” & 15”
		F679	SDR 35 / PS 46	18” to 27”
		AWWA C900	DR 18 / N/A	4” to 12”
		AWWA C909	DR 18 / N/A	4” to 12”
		AWWAC905	DR 18 / N/A	14” to 16”
Truss (Gasketed)	Contech	D2680	N/A / 200 psi	8” to 15”
Profile	Contech A-2000 Contech A-2026 ETI, Ultra-Rib ETI, Ultra-Corr	F949 F949 F794 F794	N/A / 46 psi N/A / 115 psi N/A / 46 psi N/A / 46 psi	12” to 36” 8” to 10” 8” to 30” 24” to 36”

B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner’s Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.

H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside

diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.

I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

2.4 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Division 33.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Division 33, except furnish fittings with one of following approved internal linings:
1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting.
2. Nominal 40 mils (35 mils minimum) polyurethane.
3. Nominal 40 mils (35 mils minimum) ceramic epoxy.
4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy.

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Division 33.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.2E.

2.5 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 E X E C U T I O N

3.1 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer’s recommendations.

3.2 INSTALLATION

A. Conform to requirements of Division 33, as applicable.

B. Install PVC pipe in accordance with Division 33, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:
   1. Water service pipe 12 inches in diameter and smaller 4 feet of cover.
   2. Water service pipe 16 inches in diameter and larger 5 feet of cover.

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.

F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.

G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

3.3 PVC RESTRAINED MECHANISM

A. Do not apply lubricant to spline or pipe or coupling spline grooves.

B. Do not use excessive force while inserting the spline through coupling.

C. Insert spline until it is fully seated around circumference of pipe.

D. Field Cutting of Pipe Ends:
   1. Perform by workers certified by manufacturer.
   2. Use a PVC pipe cutter and provide square ends.
   3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION

SECTION 33 06 10.15 – DUCTILE IRON PIPE AND FITTINGS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Ductile iron pipe and fittings for water mains, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

A. ANSI A 21.4 (AWWA C 104) - Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings, for Water and Other Liquids.

B. ANSI A 21.10 (AWWA C 110) - Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in., for Water and Other Liquids.

C. ANSI A 21.11 (AWWA C 111) - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

D. ANSI A 21.15 (AWWA C 115) - Flanged Ductile-Iron Pipe with Threaded Flanges.

E. ANSI A 21.50 (AWWA C 150) - Thickness Design of Ductile-Iron Pipe.

F. ANSI A 21.51 (AWWA C 151) - Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.

G. ANSI A 21.53 (AWWA C 153) - Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for water service.

H. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

I. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.

J. ASTM G 62 - Test Methods for Holiday Detection in Pipeline Coatings.

K. AWWA C 600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

L. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.

1.4 SUBMITTALS

A. Conform to requirements of Section - Submittal Procedures.

B. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings. Production of pipe and fittings prior to review by Engineer is at Contractor's risk.

1.5 QUALITY CONTROL

A. Provide manufacturer's certifications that all ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

B. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A 21.11.

PART 2 P R O D U C T S

2.1 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: ANSI A 21.15, ANSI A 21.50 or ANSI A 21.51; bear mark of Underwriters' Laboratories approval; minimum thickness Class 51 for water mains and Class 52 for sanitary sewers, or as shown on Drawings. Provide minimum thickness Class 53 for flanged pipe.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

2.2 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.15 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, bolts shall conform to requirements of AWWA C 111.

B. Where restrained joints for buried service are required by Drawings, provide one of the following, or equal:
1. Super-Lock Joint by Clow Corporation.
2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.
3. TR-Flex Joint by U.S. Pipe and Foundry Company.

C. Threaded- or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 33 13 00.10 - Hydrostatic Testing of Pipelines as applicable.

E. Where ductile iron water main is cathodically protected from corrosion, bond rubber gasketed joints as shown on Drawings to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings.

2.3 GASKETS

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material; for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed pipeline, shall have the following gasket materials for the noted contaminants:

Contaminant	Gasket Material Required
Petroleum (diesel, gasoline)	Nitrile Rubber
Other contaminants	As recommended by the pipe manufacture

2.4 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they serve.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI A 21.10; ANSI B 16.1 cast or ductile iron. Flanges: ANSI B 16.1, Class 125; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11 (AWWA C 110); pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water Mains: ANSI A 21.53; 4-inch through 12-inch diameter; cement-mortar lining; conform to requirements Division 33 - Polyethylene Wrap.

2.5 COATINGS AND LININGS

A. Water Main Interiors: ANSI A21.4, cement lined with seal coat.

B. Sanitary Sewer and Force Main Interiors:
1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.
2. Liner thickness: Nominal 40 mils, minimum 35 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6-inches back from end.
3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.
4. Acceptable Lining Materials:
   a. Virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage heat bonded to interior surface of pipe and fittings; APolyline@ by American Cast Iron Pipe Company; or equal.
   b. Polyurethane: Corro-pipe II by Madison Chemicals.
   c. Ceramic Epoxy: Protecto-401 by Enduron Protective Coatings.

C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Exterior: Prime coat and outside asphaltic coating conforming to ANSI A 21.10, ANSI A 21.15, or ANSI A 21.51 for pipe and fittings in open cut excavation and in casings.

E. Polyethylene Wrap: For buried water lines and sanitary sewers, including point repairs, provide polyethylene wrap unless otherwise specified or shown. Provide polyethylene wrap for buried ductile iron pipe, including polyurethane coated pipe. Conform to requirements of Division 33 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer as resistant to the contaminants identified in the Phase II Environmental Site Assessment Report.

2.6 MANUFACTURERS

A. Pre-approved manufacturers of ductile iron pipe are American Cast Iron Pipe Co., McWayne Cast Iron Pipe Co., and U. S. Pipe and Foundry Co.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to installation requirements of Sections 33 11 00 - Water Utility Distribution Piping, and 33 31 00 – Sanitary Utility Sewerage Piping, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in polyethylene wrap, unless cathodic protection is provided. Do not use polyethylene wrap with a cathodic protection system.

3.2 GRADE

A. Unless otherwise specified on Drawings, install ductile iron pipe for water service to clear utility lines with following minimum cover:

Diameter (Inches)	Depth of Cover (Feet)
16 and 24	5
12 and smaller	4

END OF SECTION

SECTION 33 06 40.10 - HDPE SOLID AND PROFILE WALL PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. High density polyethylene (HDPE) pipe for gravity sewers and drains, including fittings.

B. High density polyethylene (HDPE) pipe for sanitary sewer force mains, including fittings.

C. High density polyethylene (HDPE) pipe for storm sewers culverts.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Drainage Pipe, 18"- 48" diameter.

B. AASHTO Section 18 - Soil Thermoplastic Pipe Interaction Systems.

C. AASHTO Section 30 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

D. ASTM D 618 - Standard Practice for Conditioning Plastics for Testing.

E. ASTM D 1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

F. ASTM D 2321 - Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Pipe.

G. ASTM D 2657 - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.

H. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

I. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

L. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F 714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

N. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings showing design of pipe and fittings, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Provide manufacturer's certificate of conformance to Specifications.

B. Furnish pipe and fittings that are homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

C. Owner’s Representative reserves right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve manufacturer of responsibilities to provide products that comply with applicable standards and these Specifications.
   1. Manufacturer's Notification: Should Owner’s Representative wish to witness manufacture of specific pipes, manufacturer shall provide Owner’s Representative with minimum three weeks’ notice of when and where production of those specific pipes will take place.
   2. Failure to Inspect. Approval of products or tests is not implied by Owner’s Representative's decision not to inspect manufacturing, testing, or finished pipes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience of minimum 5 years of pipe installations that have been in successful, continuous service for same type of service as proposed Work.

PART 2 P R O D U C T S

2.1 GENERAL

A. For sanitary sewer pipe provide HDPE pipe as follows:
   1. NEW CONSTRUCTION PIPE PRODUCTS GRAVITY SANITARY SEWER DIRECT BURY:

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM or AASHTO	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE
02505	Solid Wall Polyethylene (HDPE)	Chevron Plexco Phillip 66 Quail Poly Pipe	ASTM F-714	DR 17 DR 21	115 46	8” – 10” 12” – 48”
02531	Polyethylene Profile Wall	Spirolite	ASTM F-894	n/a	46	18”–120”

   2. REHABILITATION CONSTRUCTION PIPE PRODUCTS SLIPLINING OF SANITARY SEWER:

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE
02550	Solid Wall Poly	Chevron Plexco Quail Poly Pipe AmeriFlow by NAPCO Ameriflow by KWH	F-714	DR 21	46	8” – 48” 3” – 12” 14” – 63”
02550	Polyethylene Profile Wall	Spirolite	F-894	n/a	46	18”–120”

B. For Storm Sewer and Residential Driveway Culverts provide HDPE as follows:
   1. N-12 and N-12 HC by Advanced Drainage Systems, Inc. (ADS).
   2. Sure-Lok F477 by Hancor, Inc.

C. Furnish solid wall pipe with plain end construction for heat joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce fused leak-free joint.

D. Furnish profile-wall gravity sewer pipe with bell-and-spigot end construction conforming to ASTM D 3212. Joining will be accomplished with elastomeric gasket in accordance with manufacturer's recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, elastomeric gasket, contained in machined groove on pipe spigot, is compressed radially in pipe bell to form positive seal. Design joint to avoid displacement of gasket when installed in accordance with manufacturer's recommendations.

E. Furnish solid wall pipe for sanitary sewer force mains with minimum working pressure rating of 150 psi, and with inside diameter equal to or greater than nominal pipe size indicated on Drawings.

F. Furnish corrugated polyethylene pipe (CPP) for gravity storm sewer pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line. Suitable joints are:
   1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged conforming to the requirements of ASTM F-477.

G. Jointing:
   1. Gaskets:
      a. Meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.
      b. Pipes allowed to be installed in potentially contaminated areas, where free product is found near elevation of proposed sewer, shall have the following gasket materials for noted contaminants:

Contaminant	**Gasket Material Required**
Petroleum (diesel, gasoline)	Nitrile Rubber

Other contaminants	As recommended by pipe manufacturer

2. Lubricant. Use lubricant for assembly of gasketed joints which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.2 MATERIALS FOR SANITARY SEWER

A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting requirements of cell classification in accordance with ASTM D 3350 are also suitable for making pipe products under these specifications.

B. Other Pipe Materials: Materials other than those specified in Paragraph 2.02A, Pipe and Fittings, may be used as part of profile construction, e.g., as core tube to support shape of profile during processing, provided that these materials are compatible with base polyethylene material and are completely encapsulated in finished product and in no way compromise performance of pipe products in intended use. Examples of suitable material include polyethylene and polypropylene.

2.3 MATERIALS FOR STORM SEWERS AND RESIDENTIAL DRIVEWAY CULVERTS

A. Pipe and Fittings: High density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in AASHTO M 294, AASHTO MP7 and ASTM D 3350.

B. Types: CPP shall meet one or both of following:
1. Type S: Outer corrugated wall with smooth inner liner.
2. Type D: Inner and outer smooth walls braced circumferentially or spirally with projections or ribs.

C. Lubricant: Use lubricant for assembly of gasketed joints, which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.4 TEST METHODS FOR SANITARY SEWER

A. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner’s Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.05A, in suitable press until internal diameter has been reduced to 40 percent of original inside diameter of pipe. Rate of loading shall be uniform and at 2 inches per minute. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles.

C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace shear load transfer bars and supports with 6-inch-wide support blocks that can be either flat or contoured to conform to pipe's outer contour.

D. Purpose of Tests. Flattening and joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

2.5 TEST METHODS FOR STOMR SEWERS AND RESDENTIAL DRIVEWAY CULVERTS

A. Pipe stiffness at 5 percent deflection, when determined in accordance with ASTM D 2412, shall be as specified in Section 7.4 of AASHTO M 294.

B. Minimum inner wall thickness shall be as specified in Section 7.2.2 of AASHTO M 294.

2.6 MARKING

A. Mark each standard and random length of pipe in compliance with these Specifications with following information:
   1. Pipe size.
   2. Pipe class.
   3. Production code.
   4. Material designation.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to requirements of Division 33.

B. Install pipe in accordance with the manufacturers recommended installation procedures.

C. HDPE pipe is not approved in applications requiring auguring of pipe.

D. Bedding and backfill: Conform to requirements of Division 31.

END OF SECTION

SECTION 33 06 40.11 – REINFORCED CONCRETE PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete pipe for storm sewers.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.3 REFERENCES

A. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe.

C. ASTM C 497 - Method of Testing Concrete Pipe, Sections, or Tile.

D. ASTM C 506 - Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.

E. ASTM C 507 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.

F. ASTM C 655 - Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.

G. ASTM C 822 - Standard Definitions and Terms Relating to Concrete Pipe and Related Products.

H. ASTM C 877 - Standard Specification for External Sealing Bands for Non circular Concrete Sewer, Storm Drain, and Culvert Pipe.

1.4 SUSTAINABLE DESIGN (LEED) REQUIREMENTS

A. GENERAL LEED REQUIREMENTS: Reference Section 01 35 45 for general information regarding sustainable requirements for this LEED Silver Project.

B. LEED PROJECT CHECKLIST: Reference the *LEED Project Checklist* (included in Section 01 35 45) for an understanding of the project's LEED goals, including quantities and percentages within the required credits.

C. LEED SUBMITTAL PROCEDURE: All Subcontractor(s) and vendor(s) providing materials and products under this Section shall be REQUIRED to submit a fully-executed *Sustainable Product Submittal Sheet* (included in Section 01 35 45) regardless of whether credits are expected for materials and products provided under this Section.

1.5 SUBMITTALS

A. Submittals shall conform to requirements in Division 1.

B. Submit complete product data for pipe, fittings, and gaskets for approval. Indicate conformance to appropriate reference standards.

C. Submit certificates by a testing laboratory, hired and paid by the manufacturer, that concrete pipes meet applicable standards when tested in accordance with ASTM C 497.

PART 2 P R O D U C T S

2.1 REINFORCED CONCRETE PIPE

A. Circular reinforced concrete pipe shall conform to requirements of ASTM C 76, for Class III wall thickness. Joints shall be rubber gasketed conforming to ASTM C 443.

B. Reinforced concrete arch pipe shall conform to the requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to the requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Joints shall be rubber gaskets conforming to ASTM C 877.

D. Reinforced concrete D-load pipe shall conform to the requirements of ASTM C 655.

2.2 GASKETS

A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by the pipe manufacturer

2.3 SOURCE QUALITY CONTROL

A. Representatives of Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to requirements of the following Sections, as applicable:
1. 33 41 00 - Storm Utility Drainage Piping.

B. Install reinforced concrete pipe in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 33 11 00 - WATER UTILITY DISTRIBUTION PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Installation of water lines.

B. Specifications identify requirements for both small diameter water lines and large diameter water lines. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings.

B. ANSI/NSF Standard 61 - Drinking Water System -Health Components.

C. ASTM A 36 - Standard Specification for Carbon Structural Steel.

D. ASTM A 536 - Standard Specification for Ductile Iron Castings.

E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes.

G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.

I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination.

K. ASTM E 709 - Standard Guide for Magnetic Particle Examination.

L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Photographs: Submit photographs conforming to requirements of Division 1 prior to commencement of construction.

D. Submit videotapes conforming to requirements of Division 1, if applicable.

E. Submit Lone Star notification transmittal number prior to beginning excavation.

F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:
   1. Disinfection; not to exceed 4,000 linear feet per section.
   2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.
   3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

PART 2 P R O D U C T S

2.1 PIPE MATERIALS

A. Install pipe materials which conform to Division 33.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

C. Type of pipe materials used is Contractor's option unless specifically identified on Drawings.

D. Provide minimum of 3/8 inch inside joint recess between ends of pipe in straight pipe sections.

2.2 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE

A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.

B. O-rings: Conform to National Sanitary Foundation requirements.

2.3 RESTRAINED JOINTS

A. Ductile-Iron Pipe: See Division 33.

B. PVC Pipe: See Division 33. Perform hydrostatic testing in accordance with ASTM F 1674.

C. Pre-stressed Concrete Cylinder Pipe, Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.6 D).

D. Restrained Joints where required on DIP and PVC pipe:
   1. Restraint devices: Manufacture of high strength ductile iron, ASTM A 536 up to 24 inches, and ASTM A 36 for sizes greater than 30 inches. Working pressure rating twice that of design test pressure.
   2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

2.4 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

A. Flexible (Dresser-type) Couplings.
   1. Install where shown on Drawings or where allowed by Owner’s Representative for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.
   2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.
   3. Provide approved flanged adapter couplings for steel pipe.
   4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of approved coal tar coating.

B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on Drawings.
   1. Body and Flap: ASTM A 126-B cast iron.

2. Seats: ASTM B 21-CA482 or ASTM B 301-CA145 bronze.
3. Resilient Seat.
4. Hinge Arms: ASTM B 584-CA865 high tensile bronze.
5. Hinge pins: ASTM B 98-CA655 silicon bronze.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.

C. Lay pipe to lines and grades shown on Drawings.

D. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes or separation of four feet minimum from force mains as specified in this Section in all directions unless special design is provided on Drawings.

E. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from Owner’s Representative before proceeding with construction.

F. Inform Owner’s Representative if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Owner’s Representative.

G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing 2 pipe installation crews shall be permitted, unless otherwise approved by Owner’s Representative.

H. Only the appropriate governing agency will handle operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.

I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.

J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Owner’s Representative.

3.2 HANDLING, CLEANING AND INSPECTION

A. Handling:
   1. Place pipe along project site where storm water or other water will not enter or pass through pipe.
   2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains,

hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.
5. Use precautions to prevent injury to pipe, protective linings and coatings.
    a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
    b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
    c. Do not lift pipe using hooks at each end of pipe.
    d. Do not place debris, tools, clothing, or other materials on pipe.
6. Repair damage to pipe or protective lining and coating before final acceptance.
7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than 6 inches, measured within 15 degrees of line parallel to pipe longitudinal axis of finished pipe, except:
    a. In surface laitance of centrifugally cast concrete.
    b. In sections of pipe with steel reinforcing collars or wrappers.
    c. Within 12 inches of pipe ends.
8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.3 EARTHWORK

A. Conform to applicable provisions of Division 31.

B. Bedding: Use bedding materials in conformance with Division 31.

C. Backfill: Use bank run sand or earth or native soil as specified in Division 31. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.

E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Owner’s Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.5 PIPING INSTALLATION

A. General Requirements:
    1. Lay pipe in subgrade free of water.

2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
3. Properly form bedding to fully support bell without wedging or blocking up bell.
4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of Owner's Representative prior to skipping any portion of Work.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Division 33 for additional requirements at critical locations.

E. Laying Large Diameter Water Line:
1. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.
2. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Owner's Representative. No additional payment will be made for higher class of pipe or improved bedding.
3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.
4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.
5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.

F. Perform following additional procedures when working on plant sites.
1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Owner's Representative and Water Production personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Owner's Representative agrees key personnel, equipment and materials are on hand to complete Work.
2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.
3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Owner's Representative and the governing agency is present to observe.
4. Coordinate with the governing agency to obtain reduction in operating pressures prior to performing connections to existing piping.
5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Owner's Representative.

6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Division 1.
7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
8. Submit to Owner's Representative Lone Star Notification transmittal number prior to beginning excavation.
9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.
10. Provide adequate notice to pipe manufacturer's representative when connecting or modifying existing pre-stressed or pretension concrete cylinder pipe.
11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Division 1.
12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Owner's Representative by noon on Thursday of week. Contact person must be accessible during weekend, have Houston Metro Area phone number, and be authorized to make emergency decisions.
13. No night work or plant shut down will be scheduled to begin two working days before or after designated Holidays.

G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide governing agency a minimum of two weeks' notice prior to shutting down existing water line.

3.6 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:
1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
5. Where preventing movement of 16-inch diameter or greater pipe is necessary due to thrust, use restrained joints as shown on Drawings.
   a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
   b. Do not include passive resistance of soil in thrust restraint calculations.
6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Owner's Representative.

B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:
1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.

3. Use galvanized or black nuts and bolts to match flange material. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.
4. Full length bolt isolating sleeves and washers shall be used with flanged connections. Furnish kits in accordance with City of Houston's "Approved Products List."
5. For in-line flange joints 30 inches in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between 12 inches in diameter and greater and 24 inches in diameter and smaller, provide Phenolic PSI with nitrite seal gasket conforming to ANSI A 21.11 mechanical joint gaskets.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):
1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.
2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-inch and smaller.
3. Furnish welded joints with trimmed spigots and interior welds for 36-inch and larger pipe.
4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to 3/4 inch as long as 1 ½ inch minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 5 degrees.
5. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.
6. Protect coal-tar-epoxy lining during welding by draping an 18-inch-wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.
7. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.
8. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.
9. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.
10. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.
11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.
12. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.
13. Welded Joints for Large Diameter Water Lines:
    a. Furnish pipe with trimmed spigots and interior welds for 36-inch and larger pipe.
    b. Use exterior welds for 30 inch and smaller.
    c. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2 ½ degrees.

d. For large diameter water lines, employ an independent certified testing laboratory, approved by Owner's Representative, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Owner's Representative for review. Owner's Representative has final decision as to suitability of welds tested.
   1) Weld acceptance criteria:
      a) Conduct in accordance with ASTM E165- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.
      b) Examine welded surfaces for the following defects:
         (1) Cracking.
         (2) Lack of fusion/penetration.
         (3) Slag which exceeds one-third (t) where (t) equals material thickness.
         (4) Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width.
         (5) Relevant linear indications in which length of linear indication exceeds three times its width.
         (6) Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge.

14. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.
15. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.
16. Provide cylindrical corrosion barriers for epoxy lined steel pipe 24-inch diameter and smaller, unless minimum wall thickness is 0.5 inches or greater.
    a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.
    b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience installing protection fittings.
    c. All steel pipe is to have cutback 3/4 inch to no greater than 1 inch of internal diameter coating from weld bevel.
    d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 213.
    e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Harnessed Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe):
   1. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.
   2. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum 1/2-inch joint recess. Use joint "diapers" minimum of 12 inches wide.
   3. For field adjustments with deflections beyond manufacturer's recommendations:
      a. Field trim spigot.
      b. Do not engage ring.

4. Harnessed joints are not permitted in areas defined on Drawings as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.
5. Install harness type joints including snap rings at straight sections of pipe.

E. Restrained Joints
1. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks.
2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of pre-stressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Owner's Representative. Make adjustments in thrust restraint lengths at no additional cost to Owner.
3. Passive resistance of soil will not be permitted in calculation of thrust restraint.
4. For 16-inch lines and larger use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.
5. Installation:
   a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
   b. Examine and clean mechanism; remove dirt, debris and other foreign material.
   c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
   d. Verify gasket is evenly seated.
   e. Do not over stab pipe into mechanism.
6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
7. Place 2500 psi concrete conforming to Division 32, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

F. Joint Grout (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):
1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Re-tempering of grout by any means is not permitted.
2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without re-tempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.
3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.
4. Follow established procedures for hot and cold weather concrete placement.
5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.
6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access

hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.

7. Interior Joints for Pipe 24 inches and Smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Owner's Representative for 20-inch pipe and smaller.
8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.
9. Remove and replace improperly cured or otherwise defective grout.
10. Strike off grout on interior joints and make smooth with inside diameter of pipe.
11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.
12. Interior Joints for Water Lines 30 inches and Larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Owner's Representative of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.
13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately 1/2 inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to Owner.

H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Owner's Representative. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.
   1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.
   2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
   3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
   4. Replace, repair, or reapply coatings and linings as required.
   5. Assessment of deflection may be measured by Owner's Representative at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
   6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.

I. Closures Sections and Approved Field Modifications to Steel, Concrete Cylinder Pipe, Bar Wrapped Pipe and Fittings:

1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.
2. Fill exposed interior and exterior surfaces with non-shrink grout.
3. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.
4. For large diameter water lines, provide minimum overlap of 4 inches of butt strap over adjacent piece on butt-strap closures.

3.7 CATHODIC PROTECTION APPURTENANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Owner's Representative.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.8 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.9 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

A. Double wrap pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.

B. Do not use polyethylene wrap if pipe is cathodically protected.

C. Conform to requirements of Division 33.

3.10 CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.

B. Unless otherwise approved by Owner's Representative, comply with the following:

1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.
2. No later than three days after completing disinfection preparatory work, execute disinfection work.
3. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
4. Do not exceed a total of 50% of total project linear feet of disturbed right-of-way and easement until site is restored in accordance with Division 1.
5. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

C. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Division 1. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000 linear feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

3.11 CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner’s Representative must inspect water line for cleanliness prior to filling.

3.12 DISINFECTION OF WATER LINES

A. Conform to requirements of Division 33.

3.13 FIELD HYDROSTATIC TESTS

A. Conform to requirements of Division 33.

END OF SECTION

SECTION 33 12 13.10 - TAPPING SLEEVES AND VALVES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Tapping sleeves and valves for connections to existing water system.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

B. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

C. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service.

D. AWWA C 110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.

E. AWWA C 200 - Standard for Steel Water Pipe - 6 in. and Larger.

F. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

G. AWWA C 500 - Standard for Metal Seated Gate Valves, for Water Supply Service.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit results of tapping sleeves NPT test opening.

C. Submit manufacturer's affidavit as required in Division1.

1.5 DELIVERY, STORAGE AND HANDLING

A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Tapping Sleeves:
   1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
   2. Branch Outlet of Tapping Sleeve:
      a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.
      b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
   3. Use cast iron split sleeve where fire service from 6-inch water line is approved.

B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:
   1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.
   2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
   3. Steel sleeves are restricted to use on pipe sizes 6 inches and larger.
   4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.
   5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.
   6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12 mil thickness.
   7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.
   8. Provide approved steel tapping sleeves.
   9. Tapping Sleeves: Provide with 3/4-inch NPT test opening for testing prior to tapping. Provide 3/4-inch bronze plug for opening.
   10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

C. Stainless Steel tapping-sleeve bodies and flange may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:
   1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.
   2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.
   3. Stainless Steel sleeves are restricted to use on pipe sizes 4 inches and larger.
   4. Body: ASTM A240 Stainless Steel, Type 304.
   5. Bolts: ASTM A193 Stainless Steel, Type 304.
   6. Nuts: ASTM A194 Stainless Steel, Type 304.
   7. Branch Outlet: Heavy Stainless Steel Pipe.
   8. Provide approved stainless steel tapping sleeves.
   9. Do not use stainless steel sleeves for taps greater than 75 percent of pipe diameter.

D. Tapping Valves: Meet requirements of Division 33 with following exceptions:
   1. Inlet Flanges:
      a. AWWA C 110; Class 125.
      b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.
   2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.
   3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

E. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Division 33.

PART 3 E X E C U T I O N

3.1 APPLICATION

A. Install tapping sleeves and valves at locations and of sizes shown on Drawings. Install sleeve so valve is in horizontally level position unless otherwise indicated on Drawings.

B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.

C. Hydrostatically test installed tapping sleeve to 150 psig for minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.

D. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than water line being tapped.

E. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

3.2 INSTALLATION

A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.

B. Tighten bolts in proper sequence so that undue stress is not placed on pipe.

C. Align tapping valve properly and attach to tapping sleeve. Insert insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.

D. Make tap with sharp, shell cutter:
1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.
2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.

E. Withdraw coupon and flush cuttings from newly-made tap.

F. Wrap:
1. For 12-inch and smaller tap, wrap completed tapping sleeve and valve in accordance with Division 2.
2. For 16-inch and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of 16 mils.

G. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).

H. Request inspection of installation prior to backfilling.

I. Backfill in accordance with Division 31.

END OF SECTION

SECTION 33 12 13.12 – WET CONNECTIONS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Wet connections for new water mains and service lines to existing water mains.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

A. AWWA C 800 - Underground Service Line Valves and Fittings.

1.4 DEFINITIONS

A. Wet connections consist of isolating sections of pipe to be connected with installed valves, draining the isolated sections, and completing the connections.

B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of a 2-inch service line.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Division 33 related to piping materials and to water distribution.

B. Corporation cocks and saddles shall conform to requirements in Division 33.

C. Valves shall conform to requirements of Section 33 12 16 – Water Utility Distribution Valves.

D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 E X E C U T I O N

3.1 CONNECTION OPERATIONS

A. Plan wet connections in such manner and at such hours as to least inconvenience public. Notify Engineer at least 48 hours in advance of making connections.

B. Do not operate valves on mains in use by Owner. Owner Representative will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Owner Representative is at job site. Connection work shall progress without interruption until complete once existing mains have been cut or plugs has been removed for making connections.

3.2 2-INCH WET CONNECTIONS

A. Tap water main. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing main. Use 2-inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

END OF SECTION

SECTION 33 12 16 – WATER UTILITY DISTRIBUTION VALVES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Gate valves.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.

C. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.

D. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.

E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.

G. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.

H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's product data for proposed valves for approval.

C. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.5 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed.

C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends.

D. Coatings for Gate Valves 2 inches and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2 inches in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.

F. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide approved double disc valves. Comply with following requirements unless otherwise specified in Drawings:
   1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
   2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
   3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
   4. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
   5. O-rings: For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.
   6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

G. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

H. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

I. Bolts: AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

J. Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:
   1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.
   2. O rings: For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.
   3. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
   4. Stem Nut: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.
   5. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.
   6. Bolts: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.
   7. Discs: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.

8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.
9. Provide bypass for valves 24 inches and larger.
10. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.
11. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.
12. Stuffing Boxes: Located on top of bonnet and outside gear case.

K. Gate valves 14 inches to 24 inches: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.
1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.
2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.
3. Ensure wedge is symmetrical and seals equally well with flow in either direction.
4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.
5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.
6. Provide high strength bronze stem and nut.
7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.
8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.
9. Provide thrust washers to the thrust collar for easy valve operation.

L. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

M. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

N. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.

O. Provide flanged joints when valve is connected to steel or PCCP.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Earthwork. Conform to applicable provisions of Division 31.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.2 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.

C. For pipe section of each riser, use only 6 inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve.

D. Assemble and brace box in vertical position as indicated on Drawings.

3.3 DISINFECTION AND TESTING

A. Assist Owner's Representative with disinfection of valves and appurtenances as required by Division 33 and test as required by Division 33.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bullheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

3.4 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground with approved paint.

END OF SECTION

SECTION 33 12 19 – WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Fire hydrants.

B. Adjustment of fire hydrants and gate valves.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

B. SSPC SP2 - Hand Tool Cleaning.

C. SSPC SP3 - Power Tool Cleaning.

D. SSPC SP10 - Near-White Blast Cleaning.

E. SSPC SP11 - Power Tool Cleaning to Bare Metal.

F. SSPC Paint Spec No.21.

G. SSPC-Paint 21 - White or Colored Silicone Alkyd Paint.

H. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II.

I. SSPC-Paint 104 - White or Tinted Alkyd Paint.

J. Federal Standard A-A-2962A - Enamel, Alkyd, Solvent Based Low VOC.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

PART 2 P R O D U C T S

2.1 HYDRANTS

A. Provide approved fire hydrants.

B. The Owner’s Representative may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at Owner’s expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty degree (360) rotation of upper barrel.

2.2 LEADS

A. Branches (Leads): Conform to requirements of Division 33.

2.3 HYDRANT PAINTING

A. New hydrants and refurbished hydrants shall be shop coated as specified herein.

B. Exterior Above Traffic Flange (Including Bolts & Nuts):
1. Surface preparation to be in accordance with SSPC-SP 10 (MACE 2) near white blast cleaned surface.
2. Coat with three coat alkyd/silicone alkyd system with total dry film thickness (DFT) of 6 - 9 mils as follows:
a. Prime Coat - Oil modified alkyd primer, to be in general conformance with SSPC Paint Specification No. 25. Total dry film thickness (DFT) 2 - 3 mils.
b. Intermediate Coat - Heavy Duty Industrial Alkyd Enamel to be in general conformance with SSPC Paint Specification No. 104, and Federal Standard A-A-2962A. Total dry film thickness (DFT) of 2 -3 mils.
c. Finish Coat - Silicone Alkyd Resin Enamelto be in general conformance with SSPC Paint Specification No. 21. Total dry film thickness (DFT) to be 2 - 3 mils. Exception – hydrant bonnet shall not be finished shop coated, only intermediate coated. Install color coded finish coating of bonnet in field.
d. Bonnet Paint - Field apply finish coat of Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Dry film thickness of 2 - 3 mils. Bonnet colors are to be as specified in Paragraph 3.01 to designate the appropriate size of water supply line.
3. Colors - Primer: Manufacturers standard color. Finish coat of hydrant body: As specified by Owner. Connection caps: Finished coated white. Paint white band of finish coat two (2) inches in width on hydrant body approximately six inches (6") above and parallel to traffic flange. Intermediate coat: Contrasting color to blue finish, such as white.

C. Field Maintenance Painting (Exterior Above Traffic Flange):
1. Surface Preparation to be in accordance with SSPC - SP2, Hand Tool Cleaning, or SSPC -SP3, Power Tool Cleaning, depending on condition of existing paint and extent of corrosion. It is not necessary to remove tightly adhered mill scale, rust, and paint. Mill scale, rust and paint are considered tightly adherent when they cannot be removed with dull putty knife. In some severe cases where it is necessary to remove majority of existing paint, surface should be cleaned in accordance with SSPC -SP11, Power Tool Cleaning to Bare Metal.
2. When surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.03.B.2 as for new hydrants. When surface is cleaned to SSPC - SP2 or SSPC - SP3, coat hydrant with Silicone Alkyd Resin Enamelin general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3 - 6 mils.

D. Exterior Below Traffic Flange:
1. Surface preparation in accordance with SSPC- SP10 (MACE 2) Near White Blast Cleaned Surface.
2. Primer and intermediate coat: coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8 - 10 mils each for total DFT of 16 -20 mils.
3. Finish coat: Water based vinyl acrylic mastic Apply one coat with dry film thickness of 6 - 8 mils. Color of finish coat to be same as finish coat for exterior above traffic flange, i.e., blue. (Acro 555 Crystal Blue, or equivalent.)

E. Interior Surfaces Above and Below Water Line Valve:

1. Material used for internal coating of hydrant interior ferrous surfaces below water line valve must be NSF certified as suitable for contact with potable water as required by Chapter 290, Rules and Regulations for Public Water Systems, Texas Natural Resources Conservation Commission.
2. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied in two or three coats, according to manufacturer's recommendations, for total dry film thickness of 12 -18 mils.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.

B. Locate nozzle center line minimum 18 inches above finish grade.

C. Place 12-inch by 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Owner’s Representative) on pumper nozzles of new or relocated fire hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by Owner’s Representative.

D. Do not cover drain ports when placing concrete thrust block.

E. Obtain Owner’s Representative’s approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.

F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to nearest Utility Maintenance Quadrant Facility.

G. Install branches (leads) in accordance with Division 33.

H. Coating Requirements:
   1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
   2. Furnish affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.

I. Field coat hydrant bonnet to indicate size of water line supplying hydrant or tested flow at the fire hydrant as directed by the Fire Marshall or Owner.

J. Remove and dispose of unsuitable materials and debris in accordance with requirements of Division 1.

END OF SECTION

SECTION 33 12 40 - VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Valve boxes for water service.

B. Meter boxes for water service.

C. Meter vaults for water service.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

F. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturers' product data for following items for approval:
1. Each type of valve box and lid.
2. Each type of meter box and cover.
3. Each type of meter vault frame and cover.

C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in State of Texas.

D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 P R O D U C T S

2.1 VALVE BOXES

A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast letter "W" into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.

C. Unless otherwise specified, uncoated cast iron.

D. Riser Pipe:
1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Division 33 or 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Division 33.
2. Provide single section of pipe.

E. Concrete for valve box placement:
1. For locations in new concrete pavement, provide strength and mix design of new pavement.
2. For other locations, provide concrete for sidewalks conforming to requirements of Division 32.

2.2 METER BOXES

A. Provide meter boxes as required by the governing authority and as shown on the drawings.

2.3 CAST-IRON METER BOXES

A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.

B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.

C. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

2.4 CONCRETE METER BOXES

A. Concrete Meter Boxes: Made of Class A concrete, with minimum 4,500 psi compressive strength, conforming to requirements of Division 32. Construct to dimensions shown on Drawings.

B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

2.5 PLASTIC METER BOXES

A. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:

ASTM	REQUIREMENT
D 256	Impact Strength = 1/9 ft.-lb./inch (Izod, Notched)
D 256	Impact Strength – 6.4 ft.-lb./inch (Izod, Un-Notched)
D 638	Tensile Strength (2.0 min.) = 3400 psi
D 648	Deflection Temperature = 170 degrees F
D 2240	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160 inch-lb.
D 790	Flexural Modulus = 90,000 psi

B. Meter boxes shall meet the following test requirements:
1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.
2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8- inch.

3. Meter box body, without lid, shall weigh approximately 7 pounds.

2.6 METER VAULTS

A. Meter vaults may be constructed of precast concrete, cast-in-place concrete, or common brick masonry unless a specific type of construction is required by Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Division 32 with minimum compressive strength of 4,500 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Division 32.

D. Grates and Covers: Conform to requirements of Division 33.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Obtain approval from Owner's Representative for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.2 VALVE BOXES

A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.
1. Install with bell on top of valve.
2. Place riser pipe in plumb, vertical position.

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.

C. Set, align, and adjust valve box so that lid is level with final grade.

D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by Owner, repaint covers black.

3.3 METER BOXES

A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.

B. Construct concrete meter boxes to dimensions shown on Drawings.

C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.

D. Do not locate under paved areas unless approved by Owner's Representative. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

3.4 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.

B. Precast Meter Vaults:

1. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 12-inch-thick bed of cement stabilized sand conforming to requirements of Division 31.
2. Seal lifting holes with cement-sand mortar or non-shrink grout.

C. Meter Vault Floor Slab:
1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.
2. Precast floor slab elements may be used for precast vault construction.

D. Cast-in-Place Meter Vault Walls:
1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.
2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
3. Set frame for cover in concrete.

3.5 FRAME AND COVER FOR METER VAULTS

A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
1. In unpaved areas, set top of meter box or meter vault cover 3 inches above natural grade. Grade area around vault to sheet flow away from vault.
2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2-inch.

3.6 BACKFILL

A. Provide cement stabilized sand in accordance with Division 31 and backfill and compact in accordance with Division 31.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION

SECTION 33 13 00.00 – DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Disinfection of potable water lines.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.1 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to Public water distribution system.

B. Contractor shall provide water for disinfection at no additional charge to the Owner.

C. Unless otherwise provided in Contract Documents, Contractor will conduct disinfection operations.

D. Coordinate chlorination operations through Owner's Representative.

3.2 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to Public water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines 8 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Owner's Representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

3.3 DISINFECTION BY CONTRACTOR

A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:

1. Use not less than 100 parts of chlorine per million parts of water.
2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.
4. Open and close valves in lines being sterilized several times during contact period.
5. If chemical compound is used for sterilizing agent, place in pipes as directed by Owner's Representative.

3.4 BACTERIOLOGICAL TESTING

A. Contractor is responsible for coordinating and paying for testing. Contractor shall provide, Owner, Architect and Engineer with test results.

B. After disinfection and flushing of water lines, bacteriological tests will be performed by the governing agency or testing laboratory in accordance with Division 1. When test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, the Contractor shall provide additional disinfection operations at no additional cost to the Owner.

3.5 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 33 13 00.10- HYDROSTATIC TESTING OF PIPELINES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Field hydrostatic testing of newly installed water pipelines.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Disinfect water system pipelines prior to hydrostatic testing.

B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to Public water distribution system.

C. Water for testing will be charged to Contractor in accordance with applicable Ordinances. Prior to hydrostatic testing, obtain a transient meter from the appropriate governing authority. Contractor shall pay all fees associated with transient meter.

D. Test pipelines in lengths between valves, or plugs, of not more than 4,000 feet.

E. Conduct hydrostatic tests in presence of Owner’s Representative.

3.2 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For small diameter pipelines, expel air and apply minimum test pressure of 125 psi. For large diameter water lines, expel air and apply minimum test pressure of 150 psi.

D. Fire water lines and mains may need to be pressure tested to 200 psi. Contractor shall coordinate requirements with local jurisdiction and local fire department.

E. Begin test by 9:00 a.m. unless otherwise approved by Owner’s Representative. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.

F. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.3 ALLOWABLE LEAKAGE FOR WATERLINES

A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

B. Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.

C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Owner's Representative for leakage during pressure test may be used to fulfill requirements of this section.

3.4 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Owner's Representative may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Division 33. Pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.

3.5 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

SECTION 33 31 00.00 - SANITARY UTILITY SEWERAGE PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video tapes become property of Owner.

1.4 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Division 33.

B. Regulatory Requirements.
1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.
2. Make notification to Owner’s Representative when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
3. Lay gravity sewer lines in straight alignment and grade.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 P R O D U C T S

2.1 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Reinforced concrete pipe is not acceptable.

2.2 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in Division 33.

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.3 APPURTENANCES

A. Stacks. Conform to requirements of Division 33.

B. Service Connections. Conform to requirements of Division 33.

C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.4 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Conform to requirements of Division 31.

B. Topsoil: Conform to requirements of Division 32.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Division 1.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.

C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Division 31 for excavations over 5 feet deep.

D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Owner’s Representative and agency or utility company for repairs or relocations, either temporary or permanent.

E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Division 2.

F. Install and operate dewatering and surface water control measures in accordance with Division 1.

G. Do not allow sand, debris or runoff to enter sewer system.

3.2 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Owner’s Representative.

B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.

C. No sewage shall be diverted into area outside of sanitary sewer.

D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Owner's Representative so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Owner's Representative.

3.3 EXCAVATION

A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Owner's Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Division 31.

3.4 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Owner's Representative.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Owner's Representative.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 6-inch separation distance.

L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.5 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and micro-tunneling work as appropriate.

3.6 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections to conform to requirements of Division 33.

B. Stacks. Construct stacks to conform to requirements of Division 33.

C. Construct manholes to conform to requirements of Division 33 as applicable. Install frames, rings, and covers to conform to requirements of Division 33.

3.7 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Division 33.

B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Division 33.

C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Division 33. Maintain piezometer installed to conform with Division 1until acceptance testing is completed.

3.8 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Division 31.

B. Backfill trench in specified lifts only after pipe installation is approved by Owner’s Representative.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Division 32.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and apply hydromulch according to requirements of Division 32.

E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and sod disturbed areas in accordance with Division 32.

3.9 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.

B. Select and use closed-circuit television equipment that will produce color video tape. Produce video tape using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows

features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:
   1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.
   2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.
   3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.

D. Provide video tapes on CD in a format compatible with Windows Media Player. Two labels are required. Place one label on the case and the other on face of each CD. Permanently label each video tape with following information.

Face of CD

Wastewater File No.: _____ Contractor's Name: _____
Inspection Type: [ ] Survey [ ] Pre-Installation [ ] Post-Installation
Tape No.: _____ Date Televised: _____ Date Submitted: _____
Basin No.: _____

CD Case

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

E. For each video tape provide completed TV Inspection Report, as attached at end of this section. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.

F. Upon completion of video tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

TELEVISION INSPECTION CODES

HEADER INFORMATION

LOCATION CODES

A	STREET ROW, HEAVY TRAFFIC
B	STREET ROW, LIGHT TRAFFIC
C	EASEMENT, POOR ACCESS
D	EASEMENT, GOOD ACCESS
E	PARKING LOT, POOR ACCESS
F	PARKING LOT, GOOD ACCESS
G	ALLEY, POOR ACCESS
H	ALLEY, GOOD ACCESS
I	OPEN AREA, POOR ACCESS
J	OPEN AREA, GOOD ACCESS

SURFACE COVER

A	ASPHALT STREET
B	CONCRETE STREET
C	SHELL STREET
D	SIDEWALK B (2)
E	TREES/SHRUBS
F	CLOSE TO FENCE
G	OPEN AREA E (5)
H	MOVABLE BUILDING
I	UNMOVABLE BUILDING
J	OVERHEAD UTILITIES
K	WATERWAY OR RAILWAY
L	HIGHWAY OR RUNWAY
M	PIPE ABOVE GROUND

PIPE TYPE

ABS	ACRYLONITRILE BUTADIENE STYRENE
BRK	BRICK
CIP	CAST IRON PIPE
CMP	CORRUGATED METAL PIPE
CON	POURED IN PLACE CONCRETE
CPP	CURED IN PLACE PIPE
DIP	DUCTILE IRON PIPE
FRP	FIBERGLASS REINFORCED PIPE
PLP	PLASTIC LINE CONCRETE PIPE
PEP	POLYETHYLENE PIPE
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
RPM	REINFORCED PLASTIC MORTAR PIPE
URC	UNREINFORCED CONCRETE PIPE
VCP	VITRIFIED CLAY PIPE

WEATHER CODES
DRY - WET

CODE DESCRIPTIONS

CRACKS

RC-RADIAL LC-LONGITUDINAL F

CODES	DESCRIPTION	USE IN
A (1)	< ½" W, 1' L	CRK
B (2)	< ½" W, 1' – 2' L	CRK
C (3)	< ½" W, >2' L	CRK
D (4)	> ½" W, < 1' L	CRK
E (5)	> ½" W, 1' – 2' L	CRK
F (6)	> ½" W, > 2' L	CRK
G (7)	HOLE IN PIPE – SMALL	
H (8)	PIPE MISSING - < 60º	
I (9)	PIPE MISSING - > 60º	

JOINTS
MJ – MISALIGNED JOINT BJ-BROKEN JOINT

DESCRIPTION		USE IN
A (3)	DRP JT > 90% CLEAR	MJ
B (6)	DRP JT 80 – 90% CLEAR	MJ
C (9)	DRP JT < 80% CLEAR	MJ
D (3)	SHF JT > 90% CLEAR	MJ
E (6)	SHF JT 80 – 90% CLEAR	MJ
F (9)	SHF JT < 80% CLEAR	MJ
G (1)	WD JT 2" – 3"	MJ
H (2)	WD JT 3" – 4"	MJ
I (3)	WD JT > 4"	MJ
J (2)	BRK JT – LIGHT	BJ
K (4)	BRK JT – MEDIUM	BJ
L (6)	BRK JT – HEAVY	BJ
N (0)	VISIBLE GASKET	MJ
O (0)	LEAKING AT JOINT	MJ

LATERALS (L)

CODES	DESCRIPTION
A (1)	PRT SER 0" – 1"
PRT SER 1" – 2"	
C (3)	PRY SER 2" – 3"
D (4)	PRT SER 3" +
EFECTI E – SERVICE CONN.	
F (6)	DEAD/UNUSED SERVICE
G (7)	FACTORY SERVICE
H (0)	PLUMBER SERVICE

ROOTS (R)

CODES	DESCRIPTION
A (1)	ROOTS - LIGHT
B (2)	ROOTS - MEDIUM
C (3)	ROOTS – HEAVY

DEBRIS (D)

CODES	DESCRIPTION
A	DEBRIS - LIGHT
B	DEBRIS - MEDIUM
C	DEBRIS - HEAVY
D	GREASE - LIGHT
E	GREASE - MEDIUM
F	GREASE – HEAVY

INFLOW/INFILTRATION (I)

CODES	DESCRIPTION
A (3)	I/I – LIGHT (0-1 GPM)
B (6)	I/I – MEDIUM (1-5 GPM)
C (9)	I/I – HEAVY (> 5 GPM)
D (2)	I/I – SOME EVIDENCE
E (4)	I/I – CONSIDERABLE EVIDENCE
F (6)	I/I – GREAT EVIDENCE
G (0)	I/I – NO EVIDENCE

ALIGNMENT (A)

DESCRIPTION	
A	BEGIN ¼ PIPE WATER
B	BEGIN ½ PIPE WATER
C	CAMERA UNDERWATER
D	END CAMERA UNDERWATER
E	END ½ PIPE WATER

END ¼ PIPE WATER

STRUCTURAL
DS-DETERIORATED; OS-OVALITY; CS COLLAPSED

CODES	DESCRIPTION	USE IN
A (3)	LINE DET – LIGHT	DS
B (6)	LINE DET – MEDIUM	DS
C (9)	LINE DET – HEAVY	DS
D (3)	OVAL < 5%	OS
E (6)	OVAL > 5% & < 10%	OS
F (9)	OVAL > 10%	OS
G (9)	COLLAPSED	CS
H (0)	PIPE DET – HEAVY	DS
L (0)	PIPE DET – LIGHT	DS
M (0)	PIPE – MEDIUM	DS
N (0)	PIPE DET – NONE	DS
O	LINE DET – NONE	DS
Z (0)	AT MANHOLE NUMBER	CS

END OF SECTION

SECTION 33 31 00.10 - ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Acceptance testing of sanitary sewers including:
1. Visual inspection of sewer pipes.
2. Mandrel testing for flexible sewer pipes.
3. Leakage testing of sewer pipes.
4. Leakage testing of manholes.
5. Smoke testing of point repairs.
6. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM C 828 - Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.

B. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

C. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

D. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

E. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.

B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Maximum allowable leakage for Infiltration or Exfiltration:
1. The total exfiltration, as determined by hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at minimum test head of 2 feet above crown of pipe at upstream manhole or 2 feet above groundwater elevation, whichever is greater.
2. When pipes are installed more than 2 feet below groundwater level, use infiltration test in lieu of exfiltration test. Total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above crown of pipe at upstream manhole.
3. Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.

D. Perform air testing in accordance with requirements of this Section and Texas Natural Resources Conservation Commission requirements. Refer to Table 33 31 00.10-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test, and Table 33 31 00.10-4, Vacuum Test Time Table, at end of this Section.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Owner's Representative. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.6 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.

B. Provide testing reports and video tape of television inspection as directed by Owner's Representative.

C. Upon completion of tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

1.7 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.

B. Coordinate testing schedules with Owner's Representative. Perform testing under observation of Owner's Representative.

PART 2 P R O D U C T S

2.1 DEFLECTION MANDREL

A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.

C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 30 31 00.10-5, Pipe vs. Mandrel Diameter, at end of this

Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Owner's Representative.

2.2 EXFILTRATION TEST

A. Water Meter: Obtain transient water meter from appropriate governmental agency for use when water for testing will be taken from public system. Conform to governmental agency requirements for water meter use.

B. Test Equipment:
   1. Pipe plugs.
   2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

2.3 INFILTRATION TEST

A. Test Equipment:
   1. Calibrated 90 degree V-notch weir.
   2. Pipe plugs.

2.4 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:
   1. Control panel.
   2. Low-pressure air supply connected to control panel.
   3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
   4. Air hoses from control panel to:
      a. Air supply.
      b. Pneumatic plugs.
      c. Sealed line for pressuring.
      d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.5 GROUND WATER DETERMINATION

A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.6 SMOKE TESTING

A. Equipment:
   1. Pneumatic plugs.
   2. Smoke generator as supplied by Superior Signal Company, or approved equal.
   3. Blowers producing 2500 scfm minimum.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Division 1.

3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.

B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.

C. Retest repaired or replaced sewer sections.

3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

A. Test Options:
1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo physical inspection prior to testing.
3. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
4. If no installed piezometer is within 500 feet of sewer segment, provide temporary piezometer for this purpose.

B. Compensating for Ground Water Pressure:
1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.

C. Exfiltration test:
1. Determine ground water elevation.
2. Plug sewer in downstream manhole.
3. Plug incoming pipes in upstream manhole.
4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 33 31 00.10-1 at end of this Section.

D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).
1. Determine ground water elevation.

2. Plug incoming pipes in upstream manhole.
3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
4. Allow water to rise and flow over weir until it stabilizes.
5. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 33 31 00.10-1 at end of this Section.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 33 01 30-2.
1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
3. For pipe sections less than 36-inch average inside diameter:
   a. Determine ground water level.
   b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.
   c. After manhole-to-manhole section of sanitary sewer main has been slip-lined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
   d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 33 31 00.10-2 at end of this Section.
   e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 33 31 00.10-2 at end of this Section for pipe diameter and length. For slip-lining, use diameter of carrier pipe.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.5 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of this Section.

B. Low Pressure Air Test:
1. Times in Table 33 31 00.10-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Natural Resources and Conservation Commission (TNRCC) Design Criteria 317.2(a)(4)(B).

		$T = 0.0850(D)(K)/(Q)$
Where:	T =	Time for pressure to drop 1.0 pounds per square inch gauge in seconds
	K =	0.000419 DL, but not less than 1.0
	D =	Average inside diameter in inches
	L =	Length of line of same pipe size in feet
	Q =	Rate of loss, 0.0015 ft^3/min./sq. ft. internal surface

2. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test.
   a. Notes:
      1) When two sizes of pipe are involved, compute time by ratio of lengths involved.
      2) Lines with 27-inch average inside diameter and larger may be air tested at each joint.

3) Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4) If joint test is used, perform visual inspection of joint immediately after testing.
5) For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.6 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:
1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 33 31 00.10-4, Vacuum Test Time Table.
3. If drop in vacuum exceeds 1 inch Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Perform hydrostatic exfiltration testing as follows:
1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:
1. Locate points of line failure for point repair.
2. Determine when point repairs are properly made.
3. Determine when service connections have been reconnected to rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for slip-lined sections.

E. Smoke Introduction:
1. Operate equipment according to manufacturer's recommendation and as approved by Owner's Representative.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation as approved by Owner's Representative.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

Table 33 31 00.10-1

WATER TEST ALLOWABLE LEAKAGE

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100 FEET
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain.

Table 33 31 00.10-2
ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Diam. (in.)	Min. Time	Length For Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	19:50	26:11	35:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	43:06	64.38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

Table 33 31 00.10-3
MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

Table 33 31 00.10-4
VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER		
	48”	60”	72”
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0
*Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C 924-85)			

Table 33 31 00.10-5
PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass (Class SN 46)	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

END OF SECTION

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

1.4 QUALITY ASSURANCE

A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections.

B. Provide manufacturer's certification to Specifications.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations.

B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use materials cracked, gouged, chipped, dented, or otherwise damaged shall not be use materials for installation.

C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.

E. Keep interiors of pipe and fittings free of dirt and foreign matter.

F. Store PVC pipe out of direct sunlight.

PART 2 P R O D U C T S

2.1 PIPE

A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.

B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Owner's Representative or otherwise shown on Drawings.

C. Existing pipe that has been removed during construction cannot be reused.

2.2 PIPE MATERIAL SCHEDULE

A. Storm Sewer Pipe: Use pipe materials that conforming to requirements specified in Division 33 and as shown on the Drawings.

B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials that conforming to requirements specified Division 33 and as shown on the Drawings.

C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

D. Pipe materials other than those listed above shall not be used for storm sewers.

2.3 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill Material: Conform to requirements of Division 31.

B. Topsoil: Conform to requirements of Division 32.

C. Use cement stabilized sand material for bedding and backfill in the pipe zone for all storm sewers.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affects traffic. Conform to requirements of Division 1.

B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights for streets and intersections while Work is in progress or where traffic is affected by Work.

C. Immediately notify agency or company owning utility lines which are damaged, broken, or disturbed. Obtain approval from Owner's Representative and agency for repairs or relocations, either temporary or permanent.

D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Division 2.

E. Install and operate dewatering and surface water control measures in accordance with Division 1.

3.2 EXCAVATION

A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Owner's Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of Work. Or use of appropriately sized grade boards which are substantially supported.

C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 6 inches.

3.3 PIPE INSTALLATION

A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.

B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Owner's Representative.

C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.

D. Install pipe with bells of pipe facing upstream of anticipated flow.

E. Form concentric joint with each section of adjoining pipe to prevent offsets.

F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Owner's Representative, provide end protection to prevent damage while using back hoes or similar powered equipment to drive home newly laid sections.

G. Keep interior of pipe clean as installation progresses.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.

J. For PVC Pipe:
   1. Provide a minimum cover as per manufacturer's requirements from top of pavement to top of pipe, but no less than 2 feet.
   2. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.
   3. Provide pipe sections in standard lengths with minimum length of 13 feet. Pipe may be field modified to shorten length no less than 4 feet, unless otherwise approved by Owner's Representative. Field modify pipe per manufacturer's recommendations.
   4. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.
   5. Provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.

3.4 PIPE INSTALLATION OTHER THAN OPEN CUT

A. Conform to requirements of Division 33 where required.

B. Not allowed for plastic sewer pipe.

3.5 INSTALLATION OF APPURTENANCES

A. Construct manholes to conform to requirements of Division 33. Install frames, grate rings, and covers to conform to requirements of Division 33.

B. Install PVC pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars.

C. Install inlets, headwalls, and wingwalls to conform to requirements of Division 33.

D. Rehabilitate existing manholes to conform to requirements of Division 33. Adjust manhole covers and inlets to grade conforming to requirements of Division 33.

E. Dimension for Type C and Type E manholes shall be as shown on Drawings.

3.6 INSPECTION AND TESTING

A. Perform post installation television inspection in accordance with Division 33. Hand held cameras may be used in storm sewers in lieu of requirements Division 33. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.

3.7 BACKFILL AND SITE CLEANUP

A. Backfill trench after pipe installation is inspected and approved by Owner’s Representative.

B. Backfill and compact soil in accordance with Division 31.

C. Repair and replace removed or damaged pavement and sidewalks as specified in Division 32.

D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and seed according to requirements of Division 32 as required.

END OF SECTION

SECTION 33 49 13 – STORM DRAINAGE MANHOLES, FRAMES AND COVERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. AASHTO -American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges.

B. ASTM A 48 -Standard Specification for Gray Iron Castings.

C. ASTM A 615 -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. AWS -D 12.1 Welding Reinforcing Steel.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 P R O D U C T S

2.1 CASTINGS

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.

B. Use clean castings capable of withstanding application of AASHTO M306-40,000 pound proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.

D. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

2.2 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

2.3 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

2.4 FINISH

A. Unless otherwise specified, uncoated cast iron.

2.5 FABRICATED RING GRATE

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.6 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming to Division 33 requirements.

B. One piece casting with dimensions to fit frame and cover.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Houston standard detail, "Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch". Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION